SECTION 27 16 19

Communications patch cords

Notes to the Specification Writer:

This Section has been written to cover most, but not all, project conditions that you will encounter. Depending on the project, you may need to add material, delete items, or modify what is currently written. Editing instructions are included throughout the document. (If this document is viewed or printed in color, these instructions appear in red specific bold italic text.)

Review this entire specification Section and edit it to meet the requirements of the specific project. Options or items where the specification writer’s input is needed are enclosed in [brackets].

 Before publishing your final version of this specifications Section, remove all red bold italic instructions.

1. GENERAL
	1. SUMMARY

### This Section includes:

#### The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on the Drawings

#### The testing, documentation, and instructions for completing the Structured Cabling System

#### Products supplied but not installed under this section, including loose equipment specified herein, which is to be turned over to the Owner at the completion of this project

### Examine the contract documents in their entirety (including drawings and specification sections in the other divisions) for requirements or work which may affect work under this section, regardless of whether such requirements or work are specifically indicated in this section.

### Contractor Shall Provide and Install

#### The Contractor shall furnish and install telecommunications passive equipment, including:

##### Intersystem connections

##### Device connections

##### Administration

#### Although such work is not specifically mentioned herein or on the Drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, without claim for additional payment.

#### The Contractor shall provide system testing and demonstration, system documentation, and instruction of Owner personnel, without claim for additional payment.

### Errors or Omissions in Drawings or Documentation

#### If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.

#### Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.

### Related Sections:

#### Section 00 00 00 – Procurement and Contracting Requirements

#### Section 01 00 00 – General Requirements

#### Section 07 84 00 – Penetration Firestopping

#### Section 26 05 26 – Grounding and Bonding for Electrical System

#### Section 27 05 26 – Grounding and Bonding for Communication Systems

#### Section 27 05 39 – Surface Raceway for Communications Systems

#### Section 27 05 53 – Identification for Communication Systems

#### Section 27 06 28 – Pathways for Communication Systems

#### Section 27 06 36 – Cable Trays for Communication Systems

#### Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

#### Section 27 11 19 – Communications Termination Blocks and Patch Panels

#### Section 27 11 23 – Communications Cable Management

#### Section 27 13 23 – Communications Fiber Backbone Cabling

#### Section 27 15 13 – Communications Copper Horizontal Cabling

#### Section 27 15 43 – Communications Faceplates and Connectors

#### Section 27 16 13 – Communications Copper Custom Cable Assemblies

#### Section 27 16 13.01 – Communications Fiber Custom Cable Assemblies

#### Section 27 17 00 – Testing of Structured Cabling Systems

## Definitions

### ANSI – American Northern Standards Institute

### AWG – American Wire Gauge

### BICSI – Building Industry Consulting Service International

### BCT – Bonding Conductor for Telecommunications

### EIA – Electronics Industry Alliance

### ETL – Intertek Certification Services

### IEC – International Electrotechnical Commission

### IEEE – Institute of Electrical and Electronic Engineers

### IDC – Insulation displacement contact

### ISO – International Standards Organization

### NECA – National Electrical Contractors Association

### NFPA – National Fire Protection Agency

### NRTL – Nationally Recognized Testing Laboratory

### TIA – Telecommunications Industry Association

### UL – Underwriters Laboratory

### Provide: Furnish, install, terminate, label, test and certify a complete operating cabling system.

### Contract Documents (CD): Design drawings, specifications, sketches and schedules provided by the Engineer as they directly relate to this scope of work and this project.

### Structured Cabling Systems (SCS) wiring is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber cable installed and configured to provide computer data and voice connectivity.

### Point–of–Entry (POE): Unmarked Manholes/Vaults at property line

### NET–POP Rooms/MPOE (Main Point of Entry): The area where the outside plant media/carrier services appear in the facility. The NET–POP contains equipment used by owner or carrier to hand–off/transition cable from outside plant into inside plant type.

### Network Center/Main Distribution Frame (MDF) Areas: This technology space houses Layer 2/3 network switching gear and other main network distribution equipment and acts as the mid–connection point between the Core/Network and the TR/IDF/access zones for all connections.

### Telecommunications Room (TR)/Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.

### Active Equipment: electronic equipment used to develop various WAN, LAN, and voice services, e.g., digital multiplexers, RS–232 controllers, Ethernet hubs, switches, routers, PBX, etc.

### Campus Backbone: cabling system consisting of media and termination hardware interconnecting POE, Net–Pop’s and Future onsite buildings.

### Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.

### Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

### Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

### Basket Cable Tray: A cable support and management system fabricated of continuous, rigid, welded steel wire mesh and available in many sizes with attachment hardware suiting multiple installation methods

### Cable Tray: vertical or horizontal open supports, usually made of aluminum or steel, which are fastened to the building structure. Cables are laid in and fastened to the trays.

### Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations.

### Channel: The end–to–end transmission path between two points at which application specific equipment is connected; encompasses all the elements of the horizontal cabling link, plus the equipment cords in the telecommunications spaces and work area.

### Cross–Connect: equipment used to terminate and tie together communications circuits.

### Cross–Connect Jumper: a cluster of twisted–pair conductors without connectors used to establish a circuit by linking two cross–connect termination points.

### Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.

### Jack: receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight–position/eight–contact modular jacks.

### Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

### LAN: Local area network.

### Link: Horizontal cabling link encompassing all components of the horizontal cabling (TO, patch panels, blocks, jumpers and patch cords that join them in the horizontal cross–connect). It is distinguished from a channel because it does not include the equipment cables/cords at the telecom spaces or work area.

### Media: twisted–pair, and fiber optic cable or cables used to provide signal transmission paths.

### Mounting Frame: rectangular steel framework, which can be equipment rack or wall mounted to support wiring blocks, patch panels, and other communications equipment.

### Outside Plant (OSP): generally, any and all portions of the cable system that runs outside of an environmentally enclosed structure and/or building with each end terminated at different buildings. This specifically includes inter–building cables, conduits, manholes, hand–holes, and innerduct.

### UTP: Unshielded Twisted Pair.

### FO: Fiber Optic

### Passive Equipment: non–electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, patch panels, wiring blocks, fiber optic shelves, etc.

### Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross–connect.

### Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross–connect fields.

### Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.

### Protectors: electrical protection devices used to limit foreign voltages on metallic communications circuits.

### Raceway: an enclosed channel designed expressly for holding wires or cables; may be of metal or insulating material. The term includes conduit, tubing, wire ways, under floor raceways, overhead raceways and surface raceways; does not include cable tray.

### Racks: An open, freestanding, floor–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

### Riser Backbone: The Riser Backbone subsystem links the main cross connect (MDF) in the equipment room to the distribution rooms (TRs).

### Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.

### Telecommunication Outlet (TO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.

### Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

### Work Area Subsystem: The connection between the telecommunications outlet and the station equipment in the work area is provided by the Work Area Subsystem. It consists of cords, adapters, and other transmission electronics.

### Wireless Access Point (WAP): Telecom outlet designated for use with wireless network devices. Such outlet shall be mounted above ceiling.

### Contractor – The successful bidder engaged to provide the work of this specification

## REFERENCES

### Most recent editions and addenda of the following documents:

### ANSI/TIA 568 series, most recent revisions, addenda and systems bulletins. All applicable

### ANSI/TIA–569 Telecommunications Pathways and Spaces, most recent revision including all relevant addenda and systems bulletins

### ANSI/TIA–606 Administration Standard for Telecommunications Infrastructure, most recent revision including all addenda and systems bulletins

### ANSI/TIA–607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, most recent revision including all addenda and systems bulletins

### ANSI/TIA–862 Structured Cabling Infrastructure Standard for Intelligent Building Systems, most recent revision including all addenda and systems bulletins

### ANSI/TIA–942 Telecommunications Infrastructure Standard for Data Centers, most recent revision including all addenda and systems bulletins

### ANSI/TIA–1179 Healthcare Facility Telecommunications Infrastructure Standard, most recent revision including all addenda and systems bulletins

### ANSI/TIA–4966 Telecommunications Infrastructure Standard for Educational Facilities, most recent revision including all addenda and systems bulletins

### TIA–TSB–162 Telecommunications Cabling Guidelines for Wireless Access Points, most recent revision including all addenda and systems bulletins

### Telecommunications Distribution Methods Manual, most recent edition

### Information Transport Systems Installation Methods Manual (ITSIMM), most recent edition

### National Electric Codes (NEC) – all applicable

### OSHA Standards and Regulations – all applicable

### Local Codes and Standards – all applicable

### UL444 – Standard for Safety of Communications Cable

### UL 1666 – Standard for Safety of Flame Propagation Height

### Local Authority Having Jurisdiction (AHJ)

### Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either

### Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor’s expense

## SYSTEM DESCRIPTION

### The Contractor will provide, install, and test a complete structured cabling system for the project’s voice and data communications systems from the Telecommunications Outlet (TO) to the Telecommunications Room (TR), and between telecommunications spaces. The Contractor will provide and install all required components as identified below.

### Copper Patch Cords

### Fiber Patch Cords

## SUBMITTALS

### Engineer’s Review

#### The Engineer’s review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.

#### With the shop drawings, the Contractor shall include an index sheet detailing all deviations from the contract documents, and will be held responsible for all deviations, unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.

#### The Engineer’s review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

### General Component Data

#### For all products covered under this Section, the Contractor shall submit the following data for each component:

##### A Specification Section

##### The Manufacturer’s name.

##### The Manufacturer’s model and part number

### Copper Patch Cords

#### In addition to the general requirements above, the Contractor shall submit the following additional data:

##### Cable identification numbers

##### Cable specifications including quantity of pairs, material, insulation, performance, attenuation, Near-End CrossTalk (NEXT), diameter, conductor size, jacket, weight, and color

##### Nominal OD

##### The length of the patch cords

##### The connector type for the patch cords

### Fiber Patch Cords

#### In addition to the general requirements above, the Contractor shall submit the following additional data:

##### Cable identification numbers

##### Cable specifications including quantity of fibers, material, insulation, jacket, wavelength, attenuation, diameter, bend radius, core, cladding, coating, buffering, weight, and color

##### Nominal OD

##### The length of the patch cords

##### The connector type for the patch cords

### Testing and Test Results

#### Refer to Section 27 17 00

## QUALITY ASSURANCE

### Standards for Materials and Equipment

#### The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.

### Installer Qualifications

#### Refer to Section 27 05 00

## DELIVERY, STORAGE, AND HANDLING

### To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling

### The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

#### Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.

#### Do not install damaged equipment. Remove environmental conditions from the site and replace damaged equipment with new equipment.

#### If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

## COORDINATION

### The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award

#### The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.

#### At minimum, the schedule shall provide dates for the start of demolition, the completion of demolition, the installation start date, the completion of copper cabling, the completion of backbone cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

### Meeting Attendance and Schedule Adherence

#### The Contractor must attend all project-related meetings and adhere to schedule set by the Project Manager.

### Final Inspection

#### The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.

#### Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

##### As-Built Drawings, in an AutoCAD format, with legible outlet address and cable paths

##### Outlet location spreadsheets

##### Warranty paperwork

##### A copy of the Final Inspection and Acceptance Signoff Sheet

## PROJECT CONDITIONS

### Project Environmental Requirements

#### Hazardous Materials Prohibition

##### The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner

#### Existing Conditions

##### Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer, in writing, of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.

##### Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and, upon approval, proceed with the necessary changes without additional cost to the Owner.

### Record Drawings

#### Keep a complete set of all telecommunications drawings in the job site office for demonstration of the actual installation work specified in this Section.

#### Use this set of drawings for no other purpose.

#### Where any material, equipment, or system components are installed differently than what is shown on the drawings, indicate the differences clearly and neatly using ink or indelible pencil.

#### Upon completion of the project, submit the record set of drawings.

## USE OF THE SITE

### Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

### When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

### Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on and when to work in these areas.

### Multiple times each day, each contractor shall remove all trash and debris from the site. Before leaving the room each day:

#### The Contractor shall replace all ceiling tiles that they have removed.

#### The Contractor shall place all furniture and equipment that they have moved back into its original location.

#### The Contractor shall return any equipment that they have disconnected to working order.

#### The Contractor’s Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.

#### It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

## CONTINUITY OF SERVICES

### Take no action that will interfere with or interrupt existing building services, unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

### The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the Contractor shall give three (3) days advance notice.

### Should building services be inadvertently interrupted:

#### The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.

#### The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

## WARRANTY

### Refer to Section 27 05 00

#  PRODUCTS

## GENERAL

### Refer to Section 27 05 00 for General Requirements

### All materials and products shall be:

#### Appropriate for the intended use

#### Recognized as such by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA) or the American National Standards Institute (ANSI)

#### Permitted by the Authority Having Jurisdiction (AHJ)

### All products shall be new, of the latest version at time of bid, and brought to the job site in original manufacturer's packaging. Used equipment and damaged material will be rejected.

### Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

### Cable lubricants specifically designed for installing communications cable may be used as needed to reduce pulling tension when pulling cable into conduit.

### Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

### All components will be approved by the Engineer and shall have the most aesthetic value possible while maintaining specified functionality. Hardware shall:

#### Be in compliance with the Construction Documents

#### Have fit and finish compatible with the existing surrounding structure

#### Be unobtrusive

#### Provide the required functionality

### All copper and fiber products shall be from a single manufacturer so that a single performance warranty covers all applications on vertical and horizontal links.

### Provide products that are suitable for the intended use, including, but not limited to environmental, regulatory, and electrical factors.

## SUBSTITUTION POLICY

### This is a performance-based specification developed from the experience of <<ClientName>> IT in providing exceptional solutions for all our facilities and departments. As such, substitution of specified products or systems is not allowed.

### Contractor shall assume all costs for removal and replacement of any product installed in substitution of those specified. Such costs shall include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

## Copper Patch cords

### All Category 6 copper patch cords shall be TX6-28™ 28 AWG UTP small diameter patch cords

### If other color patch cords are needed to designate particular applications, see Appendix A for instructions on changing patch cord colors.

#### Category 6 copper 28 AWG patch cords shall have the following attributes:

##### Cable diameter not more than 0.150 in. (3.8mm) nominal.

##### Category 6/Class E channel and component performance.

##### Exceeds all ANSI/TIA-568.2-D Category 6 and ISO 11801 Class E Edition 2.1 electrical performance requirements for all frequencies from 1 to 250 MHz

##### FCC and ANSI compliance: Meets ANSI/TIA/EIA-1096-A; contacts plated with 50 micro inches of gold for superior performance.

##### IEC compliance: Meets IEC 60603-7 c (UL) US listed: UL 1863, CSA standard C22.2.

##### PoE compliance: Meets IEEE 802.3af and IEEE 802.3at for PoE applications in bundle sizes up to 48 cables.

##### Operating temperature: 14°F to 167F (-10°C to 75°C).

##### Storage temperature: -40°F to 158°F (-40°C to 70°C).

##### Plug housing: UL94V-0 rated clear Polycarbonate.

##### Plug contact plated with 50 microinches of gold and rated to 2500 mating cycles

##### Shall include unique RapidID barcode labels

##### RoHS compliance: Compliant.

##### Flammability rating: CM/LSZH dual rated.

#### Due to miniature size of patch cords, utilize increased attenuation de-rating value of 1.9. These support 96-meter channels that include 90-meter permanent links, and 6 meters of patch cord. A channel using 10 meters total of patch cord would support a 93-meter channels

#### [CLIENT NAME] approved Category 6 TX6-28™ 28 AWG patch cords:

##### Panduit

#### [CLIENT NAME] approved parts in below table. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| *part number* | *description* |
| --- | --- |
| UTP28SP\*^ | Category 6 Performance, 28AWG, UTP Patch Cord, CM/LSZH, \* = Length, ^ = Cord color Off White (default; no designation needed), BL=Black, BU=Blue, GR=Green, RD=Red, OR=Orange, VL=Violet, YL=Yellow, GY=Gray |
| UTP28SP3BU | Category 6 Performance, 28AWG, UTP Patch Cord, CM/LSZH, 3 foot, BU=Blue |

### All Category 6A copper patch cords shall be white TX6A-28™ 28 AWG UTP small diameter patch cords

### If other color patch cords are needed to designate particular applications, see Appendix A for instructions on changing patch cord colors

#### Category 6A copper 28 AWG patch cords shall have the following attributes:

##### Cable diameter not more than 0.185 in. (4.7mm) nominal.

##### Category 6A/Class EA channel and component performance.

##### Exceeds all ANSI/TIA-568.2-D Category 6A and ISO 11801 Class EA electrical performance requirements for all frequencies from 1 to 500 MHz

##### FCC and ANSI compliance: Meets ANSI/TIA/EIA-1096-A; contacts plated with 50 micro inches of gold for superior performance.

##### IEC compliance: Meets IEC 60603-7

##### PoE compliance: Meets IEEE 802.3af and IEEE 802.3at for PoE applications in bundle sizes up to 48 cables.

##### Operating temperature: 14°F to 167°F (-10°C to 75°C).

##### Storage temperature: -40°F to 158°F (-40°C to 70°C).

##### Plug housing: UL94V-0 rated clear Polycarbonate.

##### Contacts: Gold plated phosphor bronze

##### Shall include unique RapidID barcode labels.

##### RoHS compliance: Compliant.

##### Flammability rating: CM/LSZH dual rated.

#### Due to miniature size of patch cords, utilize increased attenuation de-rating value of 1.9. These supports 96-meter channels that include 90-meter permanent links, and 6 meters of patch cord. A channel using 10 meters total of patch cord would support a 93-meter channels

#### [CLIENT NAME] approved Category 6A TX6A-28™ 28 AWG patch cords:

##### Panduit

#### [CLIENT NAME] approved parts in below table. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| *part number* | *description* |
| --- | --- |
| UTP28X\*^ | Category 6A Performance, 28AWG, UTP Patch Cord, CM/LSZH, \* = Length, ^ = Cord color Off White (default; no designation needed), BL=Black, BU=Blue, GR=Green, RD=Red, OR=Orange, VL=Violet, YL=Yellow, GY=Gray |
| UTP28X3BU | Category 6A Performance, 28AWG, UTP Patch Cord, CM/LSZH, 3 foot, BU=Blue |

## Fiber Patch cords

### Fiber patch fields within [Client Name] facilities shall utilize OM4/OM4+ (SigCore) multimode and OS2 singlemode “pull-boot” fiber jumpers (fiber patch cords) (pick fiber type that pertains to project)

### Field-terminated cable assemblies are not permitted.

### Quantities and lengths of cords shall be coordinated with and approved by the Engineer

### Cordage will be of the same manufacturer as that selected for the optical fiber and associated connectors

#### “Pull-boot” fiber jumpers (fiber patch cords) shall have the following properties:

##### Pull-boot LC Duplex Fiber Optic Patch Cords shall feature a pullable strain relief boot and duplex clip. Polarity change via 180˚ integral boot flip

##### Available in in plenum (OFNP) and low smoke zero halogen (LSZH) rated jacket materials

##### Connector insertion loss: (pick fiber type that pertains to project)

1. Optimized: 0.25dB max (OS2 only)
2. Optimized: 0.15dB max (OM4) (Note: Standard IL now performs at Optimized performance levels for multimode)
3. Ultra: 0.10dB max (OM4+ Signature Core™)

##### Connector return loss: (pick fiber type that pertains to project)

1. 26dB min (OM3 and OM4)
2. 55dB min (OS1/OS2)

##### Bend Radius (min) Short-Term: 20mm

##### Bend Radius (min) Long-Term: 40mm

##### Connector cable retention:

1. 50N (4.24lb) @ 0°
2. 19.4N (4.4lb) @ 90°

##### Connector durability: 500 mating cycles

##### Storage temperature: -40F to 158F (-40°C to 70°C)

##### Operating and installation temperature: 14F to 140F (-10°C to 60°C)

##### Standards compliance: meets or exceeds ISO/IEC 11801, TIA-568-D.3, TIA-604-10 (FOCIS-10)

##### RoHS Compliance: All patch cord components meet the requirement of Directive 2011/65/EU

#### [CLIENT NAME] approved Fiber Patch Cords:

##### Panduit

#### [CLIENT NAME] approved parts in below table. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| *part number* | *description* | *unit of**measure* |
| --- | --- | --- |
| F92ERQ1Q1SNM001F92RLU1U1ONM001 | OS2 2 Fiber 1.6mm Jacket Patch Cord Riser LC Push-Pull to LC Push-Pull Standard IL - 1mOS2 2 Fiber Uniboot 2.0mm Jacket Patch Cord LSZH LC Duplex Optimized IL – 1m | meter |
| FX2ERQ1Q1SNM001FZ2RLU1U1ONM001 | OM3 2 Fiber 1.6mm Jacket Patch Cord Riser LC Push-Pull to LC Push-Pull Standard IL - 1mOM4 2 Fiber Uniboot 2.0mm Jacket Patch Cord LSZH LC Duplex Optimized IL – 1m | meter |
| FZ2ERQ1Q1SNM001FS2ERU1U1ONM001 | OM4 2 Fiber 1.6mm Jacket Patch Cord Riser LC Push-Pull to LC Push-Pull Standard IL - 1mOM 4+ (SigCore) 2 Fiber 2.0mm Jacket Patch Cord LSZH LC Duplex Optimized IL -1m | meter |

## RAPID ID

### The solution shall include pre-labeled copper and fiber patch cords/interconnects, for easy installation and tested 100% at the factory.

#### Copper cords shall be available in Cat 5e, Cat 6 and Cat 6A.

#### Fiber cords shall be available on OS2, OM3, OM4 and OM5 Interconnects assemblies and fiber optics patch cords.

#### The fiber optic and copper patch shall have a unique serial label on each end of the cable.

##### The bar code will have an A or B respectively to identify the side of the cable

#### The solution will not require special panels or cabling.

#### All the labels shall be included standard in all patch cords copper and fiber from factory at no extra cost.

#### The RapidID software shall be available free of charge to download from the Apple or android store.

#### The codes will be read by a wireless Bluetooth scanner which will include a special design hook to avoid reading labels from other near cables and avoid damage to the cables

## CABLE BUNDLING MATERIALS

### Hook and Loop Tape

#### Provide hook and loop tape, that is at least 0.5 inches wide, of a length equal to 150% of the circumference of the cable bundle.

#### Tie wraps are not allowed on this project.

#### When used in areas considered environmental air spaces, all bundling materials must be appropriately listed.

#### [CLIENT NAME] approved Cable Bundling Materials:

##### Panduit

#### [CLIENT NAME] approved parts in below table. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| *part number* | *description* | *unit of**measure* |
| --- | --- | --- |
| HLS-75R0 | Hook & Loop Roll, 75'L (22.9m), .75"W (19.1mm), Black | roll |
| HLS-15R0 | Hook & Loop Roll, 15'L (4.6m), .75"W (19.1mm), Black | roll |
| HLB2S-C0 | Hook & Loop Stacked Strip Ties, 7.0"L (178mm), .75"W (19.1mm), 100 pcs, Black | package |
| HLC3S-X0 | Hook & Loop Tie, Cinch, 12.0"L (305mm), .75"W (19.1mm), Black | piece |
| HLM-15R0 | Hook & Loop Roll, 15' L (4.6m), .33"W (8.4mm), Black | roll |
| HLSP1.5S-X0 | Hook &amp; Loop Tie, Plenum Strip, 6.0"L (152mm), .75"W (19.1mm), Black | piece |
| HLT2I-X0 | Hook & Loop Tie, Loop Style, 8.0"L (203mm), .50"W (12.7mm), Black | piece |
| HLTP2I-X0 | Hook & Loop Tie, Plenum Loop Style, 8.0"L (203mm), .50"W (12.7mm), Black | piece |
| TTR-35RX0 | Hook and Loop Roll, 10 Roll-Pack, Low Profile, 35'L (10.7m), .75"W (19.1mm), Black | roll |
| PLT3I-C | Cable Tie, 11.4"L (290mm), Intermediate, Nylon, Natural | piece |
| PLT3S-C2 | Cable Tie, 11.5"L (292mm) Standard, Nylon, Red | piece |
| PLT8LH-C0 | Cable Tie, 27.6"L (701mm), Light-Heavy, Weather Resistant, Black | piece |
| PLT4S-M30 | Cable Tie, 14.5"L (368mm), Standard, Heat Stabilized, Black | piece |
| PLT3S-M2 | Cable Tie, 11.5"L (292mm) Standard, Nylon, Red | piece |
| PLT4I-M | Cable Tie, 14.5"L (368mm), Intermediate, Nylon, Natural | piece |

# EXECUTION

## GENERAL

### The Contractor shall input the cabling data into the cable management software.

### Provide any required screws, anchors, clamps, hook and loop, miscellaneous grounding and support hardware, etc. needed to facilitate the installation of the cable plant system.

### Furnish any special installation equipment or tools necessary to properly complete the installation.

### Failure to follow the appropriate guidelines may require the installer to provide additional material and labor required to properly rectify the situation. This shall also apply to any and all damages caused to the cables by the installer during the implementation.

### All techniques and fixtures used in the installation must minimize complexity and must allow for easy maintenance of, and ready access to, all components for test measurements.

### All materials used in installation shall be resistant to fungus growth and moisture deterioration.

### All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

## WIRING PRACTICES

### All cables shall originate and terminate at active or passive devices. Where several devices are in close proximity, use approved housing to housing connectors and adapters.

### All cables terminated in a connection plate mounted in an enclosure shall be dressed to allow cables to be removed from the enclosure and shall be of sufficient cable length to allow for service or re-termination. The plate shall either set on the floor or freely swing clear.

### Do not use nylon cable ties.

### Cable Installation in Conduit and Duct Banks

#### Through the entire length of all underground conduits, pull mandrel that is one size smaller than the conduit.

#### When pulling cable, use pulling lubrication.

#### During long or difficult runs, use a dynamometer to measure pulling tension. Place the dynamometer between the cable puller and the pull line to monitor pulling tension. Do not exceed the manufacturer’s maximum pulling tension.

#### Apply pulling grips suitable for use with copper cables to the ends of the cable. Consult the cable manufacturer to determine the appropriate pulling grip and method of attachment. Use breakaway or fuse links at the pulling grip and ensure that the correct “fuse pin” is installed in the fuse link.

#### To protect the cable ends until they are terminated, use cable caps (heat-shrinking type) to seal the ends of the cable.

#### Use cable blocks to facilitate the bending of cable. For bends between 5° and 45°, use a 45° cable block. For bends between 45° and 90°, use a 90° cable block.

#### The bend radius for all cables shall conform to manufacturer’s specifications.

## CABLE BUNDLING MATERIALS

### Use cable bundling and securing materials as required to ensure that cable runs are securely held in place both vertically and horizontally.

### Do not tighten bundling materials or securing devices so as to cause deformation of the inherent cable geometry or construction.

### Do not use cable ties or hook and latch tape to secure cable runs to other building systems (such as electrical conduit, EMT, sprinkler pipes, ceiling suspension members, etc.).

### In areas considered environment air-handling spaces, only use appropriately listed materials.

## SYSTEM ADMINISTRATION

### Uniquely identify all components of the installed system by location, function, unit, and sub-unit.

### Identify each location with a unique alphanumeric identifier.

### Assign a unique alphanumeric identifier for each equipment enclosure in the building.

### Identify each adapter module in each distribution or interconnect enclosure with an alphanumeric identifier.

### Identify optical fiber cables by a textual label that indicates its type, strand count, point of origin, and termination.

### Supply a Cable Identification Matrix

### Supply all records in compliance with ANSI/TIA 606.

### Provide a database that is Open DataBase Connectivity (ODBC) compliant, for administration of the Structured Cabling System described in this Section.

## IDENTIFICATION

### Before installing or terminating cable, confirm all specific labeling requirements with the Owner or the Owner’s Engineer.

### Cables

#### Mark each cable at each endpoint and at all intermediate pull and access points, and junction boxes with labels that indicate the origination and destination identifiers, the sheath identifier, and the strand or pair range.

#### Mark each horizontal cable on the sheath at each end with the TR, patch panel, and panel port to which the cable is wired.

## FIELD QUALITY CONTROL

### General Testing

#### Refer to Section 27 17 00 for complete testing specifications.

#### END OF SECTION 27 16 19