SECTION 27 15 13

Communications COPPER HOrIzontal cabling

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 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 <<karets>>.

Before publishing your final version of this specifications, remove all placeholders / instructions in red text.

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:

##### Horizontal cable

##### Termination hardware

##### Communications outlets

##### Intersystem connections

##### Device connections

##### Splicing and terminations

##### Testing

##### 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 11 26 – Communications Rack Mounted Power Protections and Power Strips

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

#### 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.

### Horizontal Cabling

#### Horizontal cabling includes horizontal cable, telecommunications outlet/connectors in the Work Area (WA), mechanical terminations and patch cords or jumpers located in a Telecommunications Room (TR) or Telecommunications Enclosure (TE) and may incorporate Multi-User Telecommunications Outlet Assemblies (MUTOAs) and Consolidation Points (CPs).

### Typical Equipment Room (ER)

#### A typical ER will consist of the following equipment:

##### One or more floor-mounted open racks, wall-mounted racks, or enclosures, which shall have horizontal and vertical cable management and, when floor mounted racks are used, horizontal stabilization, which may be provided by the cable runway from the rack to the wall, though if this is insufficient, shall have supports fabricated by the Contractor

##### Termination hardware supporting all horizontal and backbone cabling

##### Rack-mounted FDEs for termination and interconnection of the optical fiber backbone

##### A room-level or building-level Uninterruptible Power Supply (UPS) system

##### A rack-mounted POU

##### Fire-resistant plywood installed on at least one (1) wall at 96 inches AFF on which to install wall-mounted equipment

##### A grounding and bonding system connected to the building’s main grounding electrode system

##### A cable runway system, installed above the racks and enclosures, to support and manage the cabling that runs from the racks and enclosures to equipment in the space, which shall be fitted with all accessories required to adequately support the installed cabling, such as waterfalls, support components, and bonding components

### Pathways and Raceways

#### Pathways and Raceways are the support system for the infrastructure. All pathways and raceways shall conform to the standards referenced in Section 27 06 28 and 27 05 36.

### Using a Combination of Cable Supports

#### The preferred method for providing pathways is to use a combination of cable tray and non-continuous cable supports.

##### Cable trays shall be used for main horizontal cable pathways on all levels from the ER and TR locations.

##### Cable trays shall be installed in the main corridors.

##### In areas of low cable density, use independently-supported non-continuous cable supports in lieu of the cable tray system.

##### All backbone cable shall also follow these cable tray pathways.

##### Horizontal and auxiliary system cables shall be combed and independently bundled. Bundle ties shall be easily removed for the addition or removal of cables and shall be plenum rated.

##### To allow for future maintenance and access, the primary cable routes shall be located over corridors.

##### To protect cable from damage and to provide a suitable aesthetic appearance in areas where the cable may be exposed, such as in open-ceiling rooms, conduit or surface raceway must be used instead of non-continuous cable supports.

## 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 Cable

#### 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

### Devices

#### In addition to the general requirements above, the Contractor shall submit the following additional data for outlets, cover plates, and fiber connectors:

##### The outlet specifications, including category rating, material, wiring, termination type, wire type, and color

##### The associated faceplate

##### A drawing of each device

### 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

##### Photos of each ER and TR

## 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 work area termination hardware, including mounting boxes, faceplates, and outlets, shall match the existing wall surface color as closely as possible.

### 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.

### Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of the equipment and its installation.

### 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.

## HORIZONTAL UTP CABLE <<If all Cat6a, delete Category 6 information>>

### Category 6 Unshielded High-Performance Twisted Pair Cable – All Work Areas <<Choose between A and B – high performance vs. value>>

#### Inside 4 pair horizontal cable for <<ClientName>> facilities shall be blue jacketed plenum “LP” rated TX6000™ High Performance Category 6 UTP Copper Cable

#### In addition, performance Category 6 UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6 and ISO 11801 2nd Edition Class E channel standards.

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6 component standards.

##### Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications

##### Third party tested to comply with ANSI/TIA-568.2-D.

##### Cable diameter: Plenum 0.225 in. (5.7mm) nominal.

##### Installation temperature range: 32°F to 122°F (0°C to 50°C).

##### Operating temperature range: -4°F to 167°F (-20°C to 75°C).

##### Characterized to 550 MHz, 300 MHz above the standard.

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable.

##### OPTIONAL: For applications where UL Limited Power (LP) is desired. LP rated cables eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes and heat rise.

1. Meet TIA -184-A/ IEEE 802.3bt “LP” rating for Limited Power cable requirements.
2. UL Listed CMP-LP (0.5A) for Plenum.
3. Operating temperature range: -4°F to 194°F (-20°C to 90°C).

### Category 6 Unshielded Twisted Pair Cable – All Work Areas

#### Inside 4 pair horizontal cable for <<ClientName>> facilities shall be blue jacketed plenum rated TX6000™ Category 6 UTP Copper Cable.

#### In addition, plenum Category 6 UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6 and ISO 11801 2nd Edition Class E channel standards.

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6 component standards.

##### Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications

##### Third party tested to comply with ANSI/TIA-568.2-D.

##### Cable diameter: Plenum 0.224 in. (5.7mm) nominal.

##### Installation temperature range: 32°F to 122°F (0°C to 50°C).

##### Operating temperature range: -4°F to 167°F (-20°C to 75°C).

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable

##### OPTIONAL: For applications where UL Limited Power (LP) is desired. LP rated cables eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes and heat rise

1. Meet TIA -184-A/ IEEE 802.3bt “LP” rating for Limited Power cable requirements.
2. UL Listed CMP-LP (0.5A) for Plenum.
3. Operating temperature range: -4°F to 194°F (-20°C to 90°C).
4. Cable diameter: Plenum 0.205 in. (5.2mm) nominal.

### Category 6 Unshielded High-Performance Twisted Pair Riser (CMP) Cable – All Work Areas <<Choose between C and D – High Performance vs. Value>>

#### Inside 4 pair horizontal cable for <<ClientName>> facilities shall be blue jacketed riser rated TX6000™ High-Performance Category 6 UTP Copper Cable.

#### In addition, riser Category 6 UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6 and ISO 11801 2nd Edition Class E channel standards.

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6 component standards.

##### Meets requirements of IEEE 802.3af, IEEE 802.3at, and IEEE 802.3bt for PoE applications.

##### Third party tested to comply with ANSI/TIA-568.2-D.

##### Cable diameter: Plenum 0.243 in. (6.2mm) nominal.

##### Installation temperature range: 32°F to 122°F (0°C to 50°C).

##### Operating temperature range: -4°F to 167°F (-20°C to 75°C).

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable

### Category 6 Unshielded Twisted Pair Riser (CMR) Cable

#### Inside 4 pair horizontal cable for <<ClientName>> facilities shall be blue jacketed riser rated TX6000™ High-Performance Category 6 UTP Copper Cable.

#### In addition, riser Category 6 UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6 and ISO 11801 2nd Edition Class E channel standards.

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6 component standards.

##### Meets requirements of IEEE 802.3af, IEEE 802.3at, and IEEE 802.3bt for PoE applications.

##### Third party tested to comply with ANSI/TIA-568.2-D.

##### Cable diameter: Riser 0.210 in. (5.3mm) nominal.

##### Installation temperature range: 32°F to 122°F (0°C to 50°C).

##### Operating temperature range: -4°F to 167°F (-20°C to 75°C).

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable

### Category 6A Unshielded Twisted Pair Cable – All Work Areas, Wireless Access Points, and Security Cameras <<Choose between E (Vari-MaTriX with 0.250” diameter) and F (Vari-MaTriX HD at 0.230”)>>

#### Copper cable shall be Panduit’s Vari-MaTriX Cable (Cat 6A, UTP horizontal cable). The inside 4 pair horizonal cable for <<ClientName>> facilities shall be blue jacketed plenum “LP” rated TX6A™ UTP Copper Cable with Vari-MaTriX Technology

#### In addition, Category 6A UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6A and ISO 11801 Class EA channel standards in a 4-connector configuration up to 100 meters

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6A component standards

##### Third party tested to comply with ANSI/TIA-568.2-D

##### Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications

##### UL Limited Power (LP) rated CMP-0.7A which eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes

##### Nominal cable diameter must not exceed 0.250”

##### The nominal cable cross-sectional area must not exceed 0.05 in^2. Per the NEC 40% fill guidelines, the following minimum cable fill is required:

1. - ¾” conduit = 4
2. - 1” conduit = 7
3. - 2” conduit = 27
4. - 4” conduit = 119

##### Installation temperature range: 32°F to 140°F (0°C to 60°C)

##### Operating temperature range: -4°F to 221°F (-20°C to 105°C)

##### Weight of cable not to exceed 32 lbs./1000 ft.

##### The UTP cable must include an electrically discontinuous metallic barrier (Vari-MaTriX) to suppress the effect of alien cross talk allowing 10 Gb/s transmission. The metallic barrier is not bonded/grounded. The continuity of the metallic barrier is to be partitioned along the cable’s length into segments of varying length such that EMI immunity is uncompromised.

##### In order to minimize jobsite floor space and reduce shipping expenses, one full 44”x 44” pallet must consist of (36) - 1000’ reels

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and scrap

#### <<ClientName>> approved Manufacturer:

##### Panduit

#### <<ClientName>> approved cable part numbers in table below:

| **Part Number** | **Description** |
| --- | --- |
| PUP6AV04BU-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), Blue |
| PUP6AV04WH-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), White |

### Category 6A Unshielded Twisted Pair Cable – All Work Areas, Wireless Access Points, and Security Cameras <<Choose between E (Vari-MaTriX with 0.250” diameter) and F (Vari-MaTriX HD at 0.230”)>>

#### Copper cable shall be Panduit’s Vari-MaTriX HD Cable (Cat 6A, UTP horizontal cable). The inside 4 pair horizonal cable for <<ClientName>> facilities shall be blue jacketed plenum “LP” rated TX6A™ UTP Copper Cable with Vari-MaTriX Technology

#### In addition, Category 6A UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6A and ISO 11801 Class EA channel standards in a 4-connector configuration up to 100 meters

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6A component standards

##### Third party tested to comply with ANSI/TIA-568.2-D

##### Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications

##### UL Limited Power (LP) rated CMP-0.7A which eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes

##### Nominal cable diameter must not exceed 0.230”

##### The nominal cable cross-sectional area must not exceed 0.042 in^2. Per the NEC 40% fill guidelines, the following minimum cable fill is required:

1. - ¾” conduit = 5
2. - 1” conduit = 8
3. - 2” conduit = 32
4. - 4” conduit = 142

##### Installation temperature range: 32°F to 140°F (0°C to 60°C)

##### Operating temperature range: -4°F to 221°F (-20°C to 105°C)

##### Weight of cable not to exceed 30 lbs./1000 ft.

##### The UTP cable must include an electrically discontinuous metallic barrier (Vari-MaTriX) to suppress the effect of alien cross talk allowing 10 Gb/s transmission. The metallic barrier is not bonded/grounded. The continuity of the metallic barrier is to be partitioned along the cable’s length into segments of varying length such that EMI immunity is uncompromised.

##### In order to minimize jobsite floor space and reduce shipping expenses, one full 44”x 44” pallet must consist of (36) - 1000’ reels

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and scrap

#### <<ClientName>> approved Manufacturer:

##### Panduit

#### <<ClientName>> approved cable part numbers in table below:

| **Part Number** | **Description** |
| --- | --- |
| PUP6AHD04BU-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), Blue |
| PUP6AHD04WH-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), White |

### Category 6A Unshielded Twisted Pair Cable – All Work Areas, Wireless Access Points, and Security Cameras <<Choose between G (Vari-MaTriX with 0.250” diameter) and H (Vari-MaTriX HD at 0.230”)>>

#### Copper cable shall be Panduit’s Vari-MaTriX Cable (Cat 6A, UTP horizontal cable). The inside 4 pair horizonal cable for <<ClientName>> facilities shall be blue jacketed plenum “LP” rated TX6A™ UTP Copper Cable with Vari-MaTriX Technology.

#### In addition, Category 6A UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6A and ISO 11801 Class EA channel standards in a 4-connector configuration up to 100 meters.

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6A component standards.

##### Third party tested to comply with ANSI/TIA-568.2-D.

##### Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications.

##### UL Limited Power (LP) rated CMP-0.7A which eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes.

##### Nominal cable diameter must not exceed 0.250”.

##### The nominal cable cross-sectional area must not exceed 0.05 in^2. Per the NEC 40% fill guidelines, the following minimum cable fill is required:

1. - ¾” conduit = 4
2. - 1” conduit = 7
3. - 2” conduit = 27
4. - 4” conduit = 119

##### Installation temperature range: 32°F to 140°F (0°C to 60°C)

##### Operating temperature range: -4°F to 221°F (-20°C to 105°C)

##### Weight of cable not to exceed 32 lbs./1000 ft.

##### The UTP cable must include an electrically discontinuous metallic barrier (Vari-MaTriX) to suppress the effect of alien cross talk allowing 10 Gb/s transmission. The metallic barrier is not bonded/grounded. The continuity of the metallic barrier is to be partitioned along the cable’s length into segments of varying length such that EMI immunity is uncompromised.

##### In order to minimize jobsite floor space and reduce shipping expenses, one full 44”x 44” pallet must consist of (36) - 1000’ reels

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and scrap

#### <<ClientName>> approved Manufacturer:

##### Panduit

#### <<ClientName>> approved cable part numbers in table below:

| *Part Number* | *Description* |
| --- | --- |
| PUP6AV04BU-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), Blue |
| PUR6AV04WH-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), White |

### Category 6A Unshielded Twisted Pair Cable – All Work Areas, Wireless Access Points, and Security Cameras <<Choose between G (Vari-MaTriX with 0.250” diameter) and H (Vari-MaTriX HD at 0.230”)>>

#### Copper cable shall be Panduit’s Vari-MaTriX HD Cable (Cat 6A, UTP horizontal cable). The inside 4 pair horizonal cable for <<ClientName>> facilities shall be blue jacketed plenum “LP” rated TX6A™ UTP Copper Cable with Vari-MaTriX Technology.

#### In addition, Category 6A UTP Copper Cable must meet the following mechanical and performance criteria:

##### Exceeds requirements of ANSI/TIA-568.2-D Category 6A and ISO 11801 Class EA channel standards in a 4-connector configuration up to 100 meters.

##### Exceeds requirements of ANSI/TIA-568.2-D and IEC 61156-5 Category 6A component standards.

##### Third party tested to comply with ANSI/TIA-568.2-D.

##### Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications.

##### UL Limited Power (LP) rated CMP-0.7A which eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes.

##### Nominal cable diameter must not exceed 0.230”.

##### The nominal cable cross-sectional area must not exceed 0.042 in^2. Per the NEC 40% fill guidelines, the following minimum cable fill is required:

1. - ¾” conduit = 5
2. - 1” conduit = 8
3. - 2” conduit = 32
4. - 4” conduit = 142

##### Installation temperature range: 32°F to 140°F (0°C to 60°C)

##### Operating temperature range: -4°F to 221°F (-20°C to 105°C)

##### Weight of cable not to exceed 30 lbs./1000 ft.

##### The UTP cable must include an electrically discontinuous metallic barrier (Vari-MaTriX) to suppress the effect of alien cross talk allowing 10 Gb/s transmission. The metallic barrier is not bonded/grounded. The continuity of the metallic barrier is to be partitioned along the cable’s length into segments of varying length such that EMI immunity is uncompromised.

##### In order to minimize jobsite floor space and reduce shipping expenses, one full 44”x 44” pallet must consist of (36) - 1000’ reels

##### Descending length cable markings enable easy identification of remaining cable which reduces installation time and scrap

#### <<ClientName>> approved Manufacturer:

##### Panduit

#### <<ClientName>> approved cable part numbers in table below:

| *Part Number* | *Description* |
| --- | --- |
| PUP6AHD04BU-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), Blue |
| PUR6AHD04WH-G | Category 6A, 4-pair, 23 AWG, U/UTP, plenum, (CMP-LP 0.7A), White |

## 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.

#### <<ClientName>> approved Cable Bundling Materials:

##### Panduit

#### <<ClientName>> 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 |
| HLS1.5S-X0 | Hook & Loop Tie, Strip, 6.0"L (152mm), .75"W (19.1mm), Black | piece |
| HLS3S-X0 | Hook & Loop Tie, Strip, 12.0"L (305mm), .75"W (19.1mm), Black | piece |
| 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 |
| TTS-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.

### Install required cables, a faceplate/surface box/furniture insert, and a jack at each location designated on the Drawings.

### 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.

### Do not roll or store cable reels without an appropriate underlay.

### 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.

### Provide fire blocking at all fire rated penetrations.

### Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame retardant putty.

### Provide bushings on all conduit ends.

### 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 cable runs must be continuous from patch panel to the outlet location.

### 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

### Group and bundle all wiring by power level or signal type.

### Where specific instructions are not given, perform all wiring in strict adherence to standard industry practices as described in the referenced Telecommunications Distribution Methods Manual (TDMM), and ANSI/TIA-568 standards.

### Exercise care in wiring to avoid damaging the cables and equipment. Where conduit or chase nipples are not installed around cutouts or knockouts, use grommets.

### Where wiring of different classifications shares a common enclosure or junction box, provide metallic isolation barriers to completely electrically separate wiring groups.

### Coordinate with tradespeople in the field, and employ proper installation techniques, including earthing and bonding and adequate Electromagnetic Compatibility (EMC). The following table lists the distances that should be maintained between power sources and copper data cabling to avoid Electromagnetic Interference (EMI).

| **Condition** | **<2kVA** | **2-5kVA** | **>5kVA** |
| --- | --- | --- | --- |
| Unshielded power lines or electrical equipment in proximity to open or non-metal pathways  | 6 inches  | 12 inches  | 24 inches |
| Unshielded power lines or electrical equipment in proximity to grounded metal conduit pathway  | 3 inches  | 6 inches  | 12 inches  |
| Power lines enclosed in a grounded metal conduit (or equivalent shielding (in proximity to grounded metal conduit pathway)  | 2 inches  | 6 inches  | 6 inches  |
| Transformers and Electric Motors  | 36 inches  | 36 inches  | 47 inches  |
| Fluorescent lighting  | 12 inches | 12 inches | 12 inches |

#### These guidelines apply to properly earth-bonded tray containing communications circuits in parallel with power circuits for a distance of 45 feet or more.

#### Communications circuits, contained in properly-bonded, ventilated trough tray, shall not be placed in the same cable tray as power circuits.

### All cables shall originate and terminate at active or passive devices. Cables shall not be spliced. 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.

### All cables installed in vertical tray or chases shall be supported by means of appropriately-sized vertical cable supports on every third floor. 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.

## HORIZONTAL UTP

### Install horizontal cable in a continuous length from the point of origin to the point of termination. Group all cables and bundle them in the overhead pathways in a neat and workmanlike manner.

### The Contractor shall terminate and test all cables.

### The Contractor shall not exceed the manufacturer’s maximum pulling tension.

### Splices are not allowed.

### The Contractor shall make sure that all the materials being installed on this project are of the proper rating (Plenum or Riser) required for the pathways and spaces by local, state, and federal codes.

### No horizontal cables, including any required service loops, shall be more than 90 meters or 295 feet long. Prior to installation, the Contractor shall identify any area that cannot be reached within these constraints and shall report them to the Engineer. Do not install any data cable outside of these parameters without written approval from the Engineer.

### Install cable paths perpendicular or parallel to the ceiling structure, unless otherwise shown on the Drawings.

### Do not expose cable to water, paint overspray, paint removal products, or water-based pulling lubricants, as these substances can negatively impact the performance of the cable.

## 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 all conduits, trays, and pathways with a unique 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 backbone 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.

### Conduits and Pathways

#### Label conduits and pathways within 0.5 m (18 inches) of each end, where exposed and accessible.

#### It is recommended that the Contractor provide additional labeling every 3 m (10 feet) of exposed length

## FIELD QUALITY CONTROL

### General Testing

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

END OF SECTION 27 15 13