SECTION 27 1000

STRUCTURED CABLING

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LANL MASTER SPECIFICATION SECTION

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| --- |
| Rev. 10 Summary of Changes:  Major revision and restructure of section to comply with updated communication standards. |

Word file at <https://engstandards.lanl.gov>

This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets. This section must also be edited to delete requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.   To seek a variance from applicable requirements, contact the Engineering Standards Manual (ESM) *Communications* [POC](https://engstandards.lanl.gov/POCs.shtml#comm) (ESM Ch. 19). Please contact POC with suggestions for improvement as well. LANL personnel should submit here: [Suggested Change or Request Clarification](https://coe.lanl.gov/APs/_layouts/15/listform.aspx?PageType=8&ListId=%7b27814329-67BF-4CB6-AE52-403529FC5A67%7d&RootFolder=); Subcontractors via email to [engstandards@lanl.gov](mailto:engstandards@lanl.gov).   
  
When assembling a specification package, include sections from all applicable Divisions, especially Division 1, General Requirements.  
  
This template is developed for ML-4 projects. For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.

Seismic: If the items covered by this Section are not subject to seismic design, or are exempt per ASCE 7 paragraph 13.1.4, then prior to editing this Section to be Project-specific, refer to Sections 26 0548.16, *Seismic Controls for Electrical Systems*, and 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*, as applicable.

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PART 1 GENERAL

# SECTION INCLUDES

1. The Structured Cabling Systems (SCS) in this Section includes all required equipment and cabling to provide computer data and voice connectivity including:
2. Grounding and Bonding
3. Conduit
4. Innerduct
5. Raceway
6. Non-Continuous Supports
7. Labels and Labeling Software
8. Testing Equipment
9. Telecommunications Enclosures/Racks
10. Fiber Optic Enclosures
11. Data and Voice Patch Panels
12. Cable Supports and Management
13. Ladder Racks
14. Fiber Optic Building Backbone Cable
15. Fiber Option Campus Backbone Cable
16. Horizontal Cable
17. Wireless Access Points
18. Fiber Optic Termination Hardware
19. Face Plates
20. Modular Inserts
21. Hydra Cables
22. All other necessary components for a complete and functioning system.

# WORK INCLUDED

1. Perform Work and provide material and equipment as shown on Drawings and/or as specified and/or indicated in this Section. Completely coordinate Work of this Section with work of other trades and provide a complete and fully functional installation.
2. Drawings and Sections form complimentary requirements; provide Work specified and not shown, and work shown and not specified as though explicitly required by both. Although Work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices, and materials necessary for a sound, secure, and complete installation.
3. Any reference to Category 5e cabling system is for Legacy (existing) systems only. All new LANL installations require Category 6A cabling system.
4. Material and equipment shall be selected from the approved materials list in Appendix B in this Section for all onsite LANL facilities. This may not apply to LANL leased facilities, but requires submittals for approval.

# COORDINATION

1. Coordinate all work with Subcontract documents including, but not limited to:
2. Architectural floor plans and structural framing
3. [Civil sitework]
4. Electrical systems
5. Mechanical systems
6. Plumbing systems
7. Fire alarm systems
8. Security systems.
9. Coordinate all work with On-site Installers including, but not limited to:
   * + 1. LANL’s Installer
       2. Craft Services
       3. LANL Network Operation Center (NOC)/ISD-TS
       4. Sigma
       5. FOD(s)
       6. SSO(s)
       7. Field Engineering
       8. Electrical Trades
       9. Any other LANL groups necessary for complete project coordination that are not listed above.
10. Refer to Telecommunications Subcontract documents (drawings and specification sections) for additional information. If there are conflict(s) within the Subcontract documents, it is the responsibility of the Subcontractor to bring any and all conflicts to the immediate attention of LANL ISD-TS for resolution. Any conflict that is not brought to LANL ISD-TS for resolution will be corrected at Subcontractor’s expense.
11. Perform work so that progress of the entire project including work of other sections is not interfered with nor delayed. Obtain detailed installation information from all manufacturers of equipment provided under this Section.

# DESIGN REQUIREMENTS

* 1. Electrical Requirements

1. Main Communications Room (MCR)
2. Refer to LANL ESM Chapter 19, D60, Paragraph 1.2.I and 1.2.J for the electrical outlet requirements in the MCR. Coordinate the outlet locations in the MCR with the Electrical Subcontractor.
3. Refer to LANL ESM Chapter 19, D60, Paragraph 1.2.H.1 – Paragraph 1.2.H.4 for the lighting requirements in the MCR.
4. Telecommunications Room (TR)
5. Refer to LANL ESM Chapter 19, D60, Paragraph 1.2.I and 1.2.J for the electrical outlet requirements in the TR. Coordinate the outlet locations in the TR with the Electrical Subcontractor.
6. Refer to LANL ESM Chapter 19, D60, Paragraph 1.2.H.1 – Paragraph 1.2.H.4 for the lighting requirements in the TR.
   1. HVAC Requirements
7. Coordinate electronic equipment BTU output with LANL ISD-TS and with HVAC Subcontractor for proper cooling requirements to maintain 64 degrees – 75 degrees F temperature and 30% min – 60% max. relative humidity (non-condensing).
8. Refer to LANL ESM Chapter 19, D60, paragraph 1.2.G for more information on HVAC requirements for MCR/TRs.
9. Refer to LANL ESM Chapter 19, D60, paragraph 1.3.K for information on required temperature and humidity sensors.
   1. Telecommunication Rooms Security
10. All Telecommunication Rooms must be secured with either swipe card or lock and key entry only. Unless otherwise noted, all Telecommunications Rooms are to be keyed per LANL ISD-TS key core requirements.
11. Access to communications facilities must be restricted to LANL ISD-TS and LANL NOC personnel.
12. Access by LANL ISD-TS personnel must be available on a 7x24x365 basis.
13. All telephone and data locations within the facility served by the TR should also be accessible by LANL ISD-TS and Fire Alarm Systems (FAS) personnel.
14. Required building security or building management arrangements necessary to ensure LANL NOC personnel access will be made by LANL.
    1. Fire Alarm Systems
15. Cabling to fire alarm panel is required.
16. Subcontractor to coordinate with Fire Alarm Engineer for system requirements.
    1. Plumbing Systems
17. No water or drain piping should be routed through a MCR/TR room that is not associated with MCR/TR equipment. Should water or drain piping be routed within a MCR/TR room, it shall be either encased or provided with a leak protection jacket and a leak detection system must be provided to notify LANL ISD-TS and LANL NOC in the event of water problems.
    1. Handheld Fire Extinguishers
18. A clean agent fire extinguisher is recommended for the MCR/TR as it avoids the dry chemical powder of ordinary ABC fire extinguishers, which can impact associated equipment per ANSI/TIA-942. See NFPA 75 for guidance regarding handheld fire extinguishers.
    1. Doors
19. The doors of the MCR/TRs must be a set of double doors with a minimum of 6 feet wide and 7 feet 6 inch high, without doorsill, hinged to open outward (code permitting) or slide side-to-side, or be removable.
20. Doors must have either no center post or a removable center post to facilitate access for large equipment. For TRs smaller than 20 sq. ft., provide single doors (opening outward) with top and bottom louvers.
21. Doors must be fitted with a lock and LANL ISD-TS approved core. Latches must be equipped with an anti-pry plate or astragal to prevent forcing the door open by directly accessing the latch bolt.
22. There must be signage on the MCR/TR doors indicating the room number and “TELECOMMUNICATIONS – AUTHORIZED PERSONNEL ONLY”.

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The seismic exemptions noted below are based on ASCE 7-16. If the Code of Record for the project refers to a different version of ASCE 7, the designer is responsible to check the seismic design requirements per that applicable edition.

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* 1. Seismic:

1. Telecommunications cabling systems that are inside, or attached to, a building/structure must be installed with seismic design considerations, unless the Structural Point of Contact has deemed otherwise. For components and supports not meeting the seismic exemptions below, Subcontractor to consult Structural Engineer of Record for seismic support design requirements, if supports not designed during detailed design phase of project.
2. The following nonstructural components (raceways, telecommunications equipment and/or boxes) are seismically exempt per ASCE 7, Section 13.1.4, but shall be positively attached to the structure provided that:
3. Component weighs 400 lbs or less with center of mass located 4 ft or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping and conduit, and component importance factor is equal to 1.0 or
4. Component weights 20 lbs or less
5. Conduits less than 2.5 inch trade size are seismically-exempt per ASCE 7, Section 13.6.5.
6. Trapeze assemblies or individual rod hangers supporting raceways with component importance factor of 1.0 that comply with ASCE 7, Section 13.6.5 Exceptions are seismically-exempt.

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For ML-1 and ML-2 systems only: Follow the applicable direction in LANL ESM, Chapter 7, Section D5000, “Additional Requirements for ML-1 and ML-2 Electrical Systems” for special requirements and guidance.

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1. Refer to the following documents for additional requirements:
2. LANL ESM Chapter 5, *Structural*
3. Section 26 0529, *Hangers and Supports for Electrical Systems*
4. [Section 26 0548.16, *Seismic Controls for Electrical Systems*]

# DEFINITIONS AND ACRONYMS

1. For definitions and acronyms, refer to [COE Glossary of Terms](https://engstandards.lanl.gov/_assets/GLOS-COE-1.pdf). Definitions exist for the following terms and others: As-built, Authority Having Jurisdiction (AHJ), CFR, NEC, NFPA, Subcontractor, UL
2. **Administration:** correct and consistent use of color, labeling, and numbering when preparing and maintaining records of wire and cable work
3. **Access Point (AP):** The central or control point in a wireless cell that acts as a bridge for traffic to and from wireless devices in the cell. The AP also connects wireless devices to the wired portion of the LAN
4. **Americans with Disabilities Act (ADA):** U.S. Department of Justice regulations and guidelines under civil rights law that ensure individuals with disabilities have access to, or may use, public entities and government buildings
5. **American Wire Gauge (AWG):** The standard gauge for measuring the diameter of copper, aluminum, and other conductors
6. **Attenuation:** The effect of signal dwindling, experienced with accumulating line length or distance of radio transmission
7. **Backboards:** fire-treated void-free A-C grade 3/4 inch plywood panels used to mount termination blocks in the TR and MCR
8. **Backbone(s):** The part of a premises distribution system that includes a main cable route and facilities for supporting the cable from the equipment room to the upper floors or along the same floor to the wiring closets
9. **Bend Radius:** The radius of curvature that fiber or copper can bend without breaking or causing excessive loss
10. **Buffer tube:** Loose-fitting cover over the optical fibers in loose-tube construction, used for protection and isolation
11. **Building distribution:** Horizontal and vertical wiring that comprise the Riser System and the horizontal distribution used to connect the station outlets through the TR’s and back to the building’s MCR
12. **Cable Fill:** The ratio of cable installed into a conduit against the theoretical maximum capacity of the conduit
13. **Cabling:** A system of telecommunications cables, cords and connecting hardware that can support the connection of information technology equipment
14. **Category 5e:** This is an enhanced version of Category 5, with additional parameters specified to enable parallel transmission with full duplex across the four pairs. Enhanced Category 5 specifications for cable and connecting hardware products with transmission characteristics specified to 100 MHz, intended to support digital transmission of 1000 Mb/s
15. **Category 6A:** For cable and connecting hardware products with transmission characteristics specified to 500 MHz, used to support digital transmission of 10 Gb/s and above
16. **Channel:** The end-to-end transmission path connecting any two pieces of application-specific equipment. Equipment cables and work area cables are included in the channel
17. **Cladding:** The low refractive index material that surrounds the core of an optical fiber, usually pure silica
18. **CMP:** Fire rating approved by NFPA for plenum cable
19. **CMR:** Fire rating approved by NFPA for riser cable
20. **Conduit:** Heavy-duty casing used to enclose and conceal wire and provide additional protection for wires. Conduits should be sized for all potential voice and data communication needs
21. **Cords:** A short length of copper wire or fiber optic cable with connectors on each end. Used to connect equipment to cabling or to connect cabling segments
22. **Cross-Connect:** Action of joining wires (vertical and horizontal) at the TRs and MCR to provide service for the station outlet back from the main switch. Cross-connects are performed using standard tools and are labeled at each location according to the specifications described in this document
23. **Crosstalk:** An electromagnetic coupling between two physically isolated circuits in a system. This coupling causes a signal on one circuit to induce a noise voltage on adjacent circuits, thereby causing interference
24. **Decibel (dB):** A unit used to measure relative increase or decrease in power, voltage or current, using a logarithmic scale
25. **Decibel/kilometer (dB/km):** A unit of measurement for fiber optic attenuation
26. **EMT (Electrical Metallic Tubing):** Steel-based durable enclosures that route telecom cabling in a building or structure and protect the cabling from impact, moisture, and chemical vapors
27. **Equal Level Far End Crosstalk (ELFEXT):** Is the same as FEXT, except that the coupled signal at the remote end is relative to the attenuated signal at the remote end on the pair the signal was applied to at the local end
28. **Equipment (Telephone) room:** space (usually in the basement of a building) where dial tone or transmission service is brought into the building, campus wiring is terminated, and wiring is distributed throughout the building
29. **Far End Crosstalk (FEXT):** Refers to the undesired coupling of signals from the transmit pair onto the receive pair at the other (= far) end. FEXT isolation is also expressed in dB. For some applications this is an important parameter, for most applications however, the NEXT values are more important
30. **Fiber optics:** Thin glass filaments that transmit signals as very high-frequency light pulses
31. **Firestop:** A material, device, or assembly of parts in an architectural barrier to prevent vertical or horizontal passage of flame, smoke, water, or gases through the rated barrier
32. **Fusion Splice:** The process of fusing or welding two fibers together usually by an electric arc
33. **High Band (Ultim8) block:** A wall mounted Krone-style termination block used for cross connection or patching
34. **Horizontal distribution (also called station wiring**): Wires connecting the station outlet (jack) to the TR
35. **Hybrid cable:** An assembly of two or more different types of cable units, cables or categories covered by an overall sheath, which may be covered by an overall shield
36. **Hydra cable:** An assembly of 12 patch cables used in the MCR or TR to connect a switch to a patch panel or a switch to a wall mounted ULTIM8 block
37. **IMC (Intermediate Metal Conduit):** Thinner, lighter-weight version of rigid metal conduit and is approved for use in the same applications as RMC
38. **Install:** Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project
39. **Inter-building wire and cable:** Support network of copper and fiber optic cable providing high-speed and low-speed data transport between buildings
40. **Interference:** A signal impairment caused by the interaction of another unwanted signal
41. **Intra-building wire and cable:** Support network of copper and fiber optic cable providing high-speed and low-speed data transport inside a building
42. **Jack (also called station outlet):** Wire termination assembly that allows network equipment to connect to LANL ISD-TS voice and data services
43. **J-hook:** A supporting device for horizontal cables that is typically shaped like a J. It can be attached to different building structures for support. Horizontal cables are laid in the opening formed by the J to provide support for the cables
44. **LAN (Local Area Network):** Association of personal computer or workstation users who share information and communicate via LANL’s network distribution systems, inter-building cable, and related network server equipment. LAN users may access the HSDN (High-speed Data Network) for high-speed access to file servers, data bases, and other LANs both within and outside LANL
45. **Link:** A transmission path between two points, not including terminal equipment, work area cables, and equipment cables
46. **MCR (Main Communications Room also called equipment room):** Usually located in a building’s basement, where dial tone and optical fiber is brought into the building, campus wire is terminated, and wire is distributed through the building
47. **Megabits per second (Mb/s):** A unit of measure used to express the data transfer rate of a system, device, or communications channel
48. **Megahertz (MHz):** A unit of frequency equal to one million cycles per second (hertz)
49. **Mule/Pull tape -** Pull string in a conduit to allow for future access for pulling more cable through existing conduit
50. **Multimode fiber:** Optical fibers that have a large core and that permit nonaxial rays or modes to propagate through the core. 50 micron (OM3) is the common standard core size for premises cabling systems. 62.5 micron (OM1) is necessary for some legacy applications and will be called out on the drawings where required. OM4 fiber is not commonly used but may be required for specific applications
51. **Near End Crosstalk (NEXT):** Refers to the undesired coupling of signals from the transmit pair onto the receive pair on the same (= near) end. NEXT isolation is expressed in dB and is a measure of how well the pairs in a cable are isolated from each other
52. **Network equipment:** terminals or other equipment located at the station, connected to the Network via a jack, or connected to the Network through the wiring closet. This equipment may include a personal computer, terminal, telephone, fax machine or modem
53. **New:** Unused material manufactured within the past two years
54. **Noise:** The term used for spurious signals produced in a conductor by sources other than the transmitter to which it is connected. Noise can affect a legitimate signal to the extent that it is inaccurate or indecipherable when it reaches the receiver. The higher the speed of data transmission, the worse the effects of noise become
55. **Optical fiber:** A transmission medium consisting of a core of glass or plastic surrounded by a protective cladding. Signals are transmitted as light pulses introduced into the fiber by a light transmitter i.e., Laser or an LED
56. **OTDR (Optical Time-Domain Reflectometer):** A device that tests the integrity of a fiber cable and is used for the building, certifying, maintaining, and troubleshooting fiber optic systems
57. **Outlets:** A term used to describe the sockets provided in the work location of a structured cabling system. These are usually 8-pin modular sockets which can support a variety of services e.g., voice, video, and data
58. **Patch cord(s):** Flexible cable unit or element with connector(s), used to establish connections from a patch panel to network equipment or from an outlet to terminal equipment
59. **Patch panel(s):** Termination and administration hardware designed to accommodate the use of patch cords. It facilitates administration for moves and changes. The default standard of termination in the telecom room is a 110-style patch panel for all new Category 6A cabling and as noted on the drawings for Category 5e cabling
60. **Pathway(s):** Designated cable routes and/or support structures in a false floor or ceiling
61. **Permanent link:** The transmission path between two mated interfaces of terminated cabling, excluding equipment cables, work area cables and cross-connections. (Typically, permanent link is between the patch panel and the outlet.)
62. **Plenum:** A designated area used for transport of environmental air as part of the air distribution system. Because it is part of the air distribution system, cables installed in this space require a higher fire rating
63. **Plenum cable:** A cable with flammability and smoke characteristics that meet the safety requirements of the National Electrical Code® (NEC®) that allow it to be routed in a plenum area without being enclosed in a conduit
64. **Plenum rated:** Meeting flammability and smoke requirements for the purpose of fire, life, and safety as described by the National Electrical Code® (NEC®)
65. **Poke-thru**: A penetration through the fire-resistive floor structure to permit the installation of electrical and/or communications cables
66. **Primary Bonding Busbar (PBB):** A busbar placed in a convenient and accessible location and bonded, by means of the bonding conductor for telecommunications, to the building service equipment (power) ground
67. **Provide:** “Furnish” and “Install”
68. **PVC:** Polyvinyl Chloride (Non-Metallic Conduit)
69. **Raceway system:** System for distribution of media and equipment, including trays, conduit, and wire mold that can carry concealed wire between non-aligned telephone closets and may, in some situations, extend to the station location
70. **Riser system (also called vertical distribution):** How telecommunications cabling is distributed among floors of a multi- story building
71. **RMC (Rigid Metal Conduit):** Heavy-duty galvanized steel tubing that is installed with threaded fittings. It is typically used outdoors to provide protection from damage for telecommunications cabling
72. **Secondary Bonding Busbar (SBB):** A common point of connection for telecommunications system and equipment bonding to ground; located in the telecommunications room or equipment room
73. **Single-mode:** Optical fiber with a small core diameter in which only a single-mode is capable of propagation. 8.3 micron is the common standard core size
74. **Sleeve (SL):** A short section of conduit, either metallic or non-metallic, lining an opening in the wall or floor for cables to pass through
75. **Splice:** A joining of conductors or fibers, generally from separate cables
76. **Standards:** Set of guidelines used as a framework for installing wire and cable for voice and data transmission
77. **Station (STA):** Telecommunications end-user location. Usually dedicated to a single-user location and function (e.g., a telephone or computer hookup work area outlet)
78. **Station Wiring (also called horizontal distribution):** Describes wires that connect station outlets (jacks) to the TR
79. **Structured Cabling:** Flexible cabling scheme which allows rapid re-configuration for office moves through patching
80. **SYSTIMAX SCS:** Brand name of CommScope structured cabling system
81. **Telecommunications Bonding Backbone (TBB):** A conductor utilized to interconnect two or more telecommunications bonding backbones
82. **Telecommunications Bonding Conductor (TBC):** A conductor that interconnects the primary bonding busbar (PBB) to the secondary bonding busbar (SBB)
83. **Telecommunications Equipment Bonding Conductor (TEBC):** Should be installed from each piece of equipment to the telecommunications grounding busbar or primary bonding busbar
84. **Telecommunications Outlet (TO):** A socket where the horizontal cable terminates. The telecommunications outlet provides the interface to the work area cabling
85. **Telecommunications Room (TR):** An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. The telecommunications closet is a recognized cross-connect point between the backbone and horizontal cabling subsystems
86. **Terminal Equipment:** Telephones, data communication equipment, and peripherals used at station locations
87. **Termination Blocks:** Location of the cross-connect fields used to connect and administer station wire. The standard required at LANL is the Ultim8 Termination block for Category 5e cabling and only as noted in the drawings
88. **TIA:** Telecommunications Industry Alliance. The TIA publishes standards used for testing Category 5e, Category 6 and Category 6A UTP
89. **Twisted pair:** Two insulated copper wires twisted together, with a 4-pair total sharing a common outer insulation or sheath; 23 gauge
90. **Unshielded twisted pair (UTP) cable:** An electrically conducting cable comprising one or more pairs none of which is shielded
91. **Wireless LAN:** Local area network that communicates using radio technology
92. **Work area:** A building space where the occupants interact with telecommunications terminal equipment. i.e., a user’s work area, which is typically 9 sq. meters or 100 sq. feet
93. **110 Hardware:** Type of termination block used to cross-connect vertical and horizontal distribution at TR and MCR locations

# RELATED SECTIONS

1. Section 01 2500, *Substitution Procedures*
2. Section 01 3300, *Submittal Procedures*
3. Section 01 7839, *Project Record Documents*
4. [Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*]
5. Section 07 8400, *Firestopping*
6. Section 26 0529, *Hangers and Supports for Electrical Systems*
7. Section 26 0536, *Cable Trays for Electrical Systems*
8. [Section 26 0548.16, *Seismic Controls for Electrical Systems*]
9. Section 26 0553, *Identification for Electrical Systems*

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For LANL adopted editions of NFPA, refer to ESM Chapter 2, Attachment 1. ASCE 7 adopted version is based on LANL adopted edition of IBC (refer to ESM Chapter 16, Att. A). For all other standards without an edition/year, the latest edition is to be used.

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# REFERENCES

1. ANSI/BICSI 002, Data Center Design and Implementation Best Practices
2. ANSI/BICSI 006, Distributed Antenna System (DAS) Design and Implementation Best Practices
3. ANSI/BICSI 008, Wireless Local Area Network (WLAN) Systems Design and Implementation Best Practices
4. ANSI/BICSI N1, Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure
5. ANSI/BICSI N2, Practices for the Installation of Telecommunications and ICT Cabling Intended to Support Remote Power Applications
6. ANSI/BICSI N3, Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure
7. ANSI/ICEA S-84-608, Telecommunications Cable Filled, Polyolefin Insulated, Copper Conductor Technical Requirements
8. ANSI/ICEA S-90-661, Category 3, and 5e Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communications Wiring Systems
9. ANSI/NEMA WC 66/ICEA S-116-732, Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in LAN Communication Wiring Systems
10. ANSI/TIA-568.0, Generic Telecommunications Cabling for Customer Premises
11. ANSI/TIA-568.1, Commercial Building Telecommunications Infrastructure Standard
12. ANSI/TIA-568.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard
13. ANSI/TIA-568.3, Optical Fiber Cabling and Components Standard
14. ANSI/TIA-569, Telecommunications Pathways and Spaces
15. ANSI/TIA-606, Administration Standard for Telecommunications Infrastructure
16. ANSI/TIA-607, Telecommunications Bonding and Grounding (Earthing) for Customer Premises
17. ANSI/TIA-758, Customer-Owned Outside Plant Telecommunications Infrastructure Standard
18. ANSI/TIA-862, Structured Cabling Infrastructure Standard for Intelligent Building Systems
19. ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers
20. ASCE 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures
21. BICSI Information Technology Systems Installation Methods Manual (ITSIMM)
22. BICSI Outside Plant Design Reference Manual (OSPDRM)
23. BICSI Telecommunications Distribution Methods Manual (TDMM)
24. NEMA BI-50016, Cable Tray Installation Guidelines
25. NFPA 70, National Electrical Code (NEC)
26. NFPA 75, Standard for the Fire Protection of Information Technology Equipment
27. TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
28. TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fiber Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant-Single-Mode Attenuation and Optical Return Loss Measurement
29. T-526-14, Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant;IEC 61280-4-1 Edition 3.1, Fiber Optic Communications Subsystem Test Procedures – Part 4-1: Installed Cable Plant – Multimode Attenuation Measurement
30. Underwriters Laboratories (UL) Cable Certification and Follow Up Program
31. 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities

# SUBMITTALS

1. Provide submittals in accordance with the requirements of Section 01 3300, *Submittal Procedures*.
2. Action Submittals:
3. Material and equipment not listed in the approved materials list in Appendix B in this Section or drawings require submittals. Submittals must include, but not limited to, the following telecommunication components.
   1. Faceplates [and Wall Telephone Faceplate (Category [5e and] 6A)]
   2. Modular Inserts (Category [5e and] 6A)
   3. Horizontal Cable (Category [5e and] 6A)
   4. Data Patch Panels (Category [5e and] 6A)
   5. UTP Line/Patch (Category [5e and] 6A)
   6. Fiber Optic Backbone Cable
   7. Fiber Optic Line/Patch Cables
   8. Fiber Optic Termination Hardware
   9. Innerduct
   10. Telecommunications Enclosures/Racks
   11. Cable Supports and Management
   12. Cable Runway/Ladder Rack
   13. Firestopping Material
   14. Other items as requested
4. Installer Qualifications and Certifications
5. Test Reports for Cable Testing
6. Informational Submittals:
7. Each type of pre-cast maintenance hole or handhole
8. Each type of conduit
9. Each type of conduit fitting
10. Each type of concrete to be used
    1. Subcontractor must submit a copy of each concrete delivery receipt. The submittal must include the date, strength ordered, and location used
11. Each type of maintenance hole or handhole racking
12. Each type of maintenance hole or handhole grounding rod
13. Each type of rebar
14. Each type of Pole
15. Each type of Guy Wire
16. Each type of Anchor
17. Project Record documents (including redlines) at closeout per Section 01 7839, *Project Record Documents*
    1. “Redlines” drawings of each floor plan documenting the location and labeling of each telecommunication outlet and the approved LANL labeling scheme. These drawings must be provided in PDF format (electronic media).
    2. In addition – Telecommunications Subcontractor must provide wireless access point outlet numbering list to LANL ISD-TS minimum 30 days prior to access point installation in field.
    3. Redline drawings must document the rack and wall field elevations in the MCR and TRs.
    4. Test results of all the telecommunication systems called out in Part 3.
18. Warranty

# QUALITY ASSURANCE

1. All devices must comply with ANSI/TIA-568, ANSI/TIA 569, and ANSI/TIA 606.
2. Qualifications:
3. Subcontractor must be thoroughly familiar with the cabling methods set forth in BICSI TDMM and unless otherwise specified, must supervise the installation in accordance with the recommendations and practices outlined in BICSI Telecommunications Cabling Installation Manual.
4. Installer must be a SYSTIMAX Partner PRO.
5. Subcontractor must have at least five (5) years' experience installing and servicing Telecommunication Systems and must provide a list of completed projects equivalent in size and complexity to this project, with contact names and telephone numbers.
6. Subcontractor must submit in writing a list of qualified technicians assigned to this project, including relevant manufacturer’s training programs completed by each, and years of related experience of each.
7. All installers that will be deployed by the Subcontractor must be Registered BICSI ITS Installer(s), two for both copper and optical fiber. The Subcontractor’s onsite Project Manager must be a Registered BICSI Technician or Registered Telecommunications Project Manager (RTPM).
8. Subcontractor must have at least one BICSI Registered Communication Distributed Designer (RCDD) on staff.
9. Subcontractor must maintain an office or competent technical presence with appropriate testing equipment and replacement parts within 2 hours drive time from this project.
10. Within 30 days of the Notice to Proceed, certifications of the qualifications of all staff noted in this Article must be submitted to LANL ISD-TS.

# WARRANTY

1. Provide a twenty (25) year manufacturer’s extended product warranty and application assurance warranty for the Category [5e and] 6A copper systems and fiber optic cabling.
2. If alternate telecommunications cabling systems and solutions are proposed by the Subcontractor in accordance with Article [1.2] *Work Included*, and accepted by LANL, the Installer must be a certified Vendor/Installer capable of providing the manufacturer’s 25- year extended warranty.
3. Proof of participation in warranty programs must be provided as part of the Installer’s bid response.

PART 2 PRODUCTS

1. PRODUCT OPTIONS AND SUBSTITUTIONS
2. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures.*
3. GROUNDING AND BONDING
   * 1. Provide suitable telecommunications grounding for equipment as required per ANSI/TIA-607 (telecommunications grounding), IEEE Emerald Green book, and NEC requirements*.*
4. The Primary Bonding Busbar (PBB) installed in the MCR must be 20 inches long and 4 inches wide by ¼ inch thick with predrilled NEMA bolt hole sizing and spacing.
5. The Secondary Bonding Busbar (SBB) installed in the Telecommunications Room (TR) must be 10 inches long and 2 inches wide by ¼ inch thick with predrilled NEMA bolt hole sizing and spacing.
   * 1. All TR racks and/or cabinets contained within the MCR and the TR must be grounded/bonded together with #6 AWG, and then bonded/grounded with minimum #6 AWG to the SBB.
     2. All metallic telecommunications raceways and cable trays must be effectively bonded back to the nearest PBB or SBB.
6. Bond the telecommunications cable tray to the PBB or SBB with minimum #6 AWG using crimp-on lugs.
7. Bond metallic raceways entering the telecommunications room and containing telecommunications cables to the PBB or SBB with crimp-on lug.
8. Use #12 AWG conductor for individual conduits 1 in. and smaller
9. Use #6 AWG conductor for multiple conduits or individual conduits larger than 1 in.
   * 1. The PBB in the MCR must be bonded to the SBBs in each TR through a Telecommunications Bonding Conductor (TBC). This TBC must be continuous and extend from the MCR to the TR that is physically furthest from the MCR. The TBC must not be daisy chained from SBB to SBB. Unnecessary connections or splices to the TBC must be avoided. The size of the TBC must be coordinated with LANL ISD-TS and LANL Engineering Services, must be in compliance with NEC and must be no larger than the Main Electrical Ground.
     2. On projects that have more than 3 floors and that have more than one TR per floor, either bond the SBBs to building steel or provide a grounding equalizer on every third floor between the two TRs on that floor. The size of the Grounding Equalizer must be coordinated with LANL ISD-TS. The Grounding Equalizer must be smaller than or equal in size to the TBC.
10. CONDUIT
11. Unless otherwise noted, all conduit must be EMT, IMC or PVC as designated on drawings.
12. Unless otherwise noted, the minimum size of conduit must be 1 inch. Refer to the Drawings for the trade size of the conduit.
13. Pull boxes must be sized as follows: length and width of each pull box must be three times the trade size diameter of the largest conduit in addition to the sum of the trade sizes of the remaining conduit. the height of the pull box must be equal to 2 inch plus the trade size diameter of the largest conduit.
14. Unless otherwise noted, do not use conduit bodies (LB, LR, etc.) in any conduit pathway system for telecommunications. If conduit bodies are allowed by LANL ISD-TS, provide communications rated conduit bodies.
15. Provide insulating bushing or insulated throat fitting for both ends of all metallic telecommunications conduits.
16. INNERDUCT
17. Unless otherwise noted, all fiber optic cables must be installed in innerduct.
18. Provide and install quantity of innerduct to protect the quantity and lengths of optical fiber furnished in this project.
19. Refer to Subcontract Documents for quantities, pathways, and locations.
20. RACEWAY
21. Where a dual channel raceway is specified that will be split between electrical and communications with a dielectric separation, provide LANL ISD-TS approved raceway. Install communications channel on the top of the dual communication/electrical raceway. Provide and install all inserts and modules necessary for a complete installation.
22. NON-CONTINUOUS SUPPORTS
23. Where indicated, and wherever cable is placed outside of conduit, raceway, or other continuous supports, communications cable will be supported by approved non-continuous support devices. These may include but are not limited to J-hooks and straps.
24. LABELS AND LABELING SOFTWARE
25. Provide and install labeling and labeling software from one of the following manufacturers:
26. Panduit
27. Brady Worldwide
28. Brother International.
29. TESTING EQUIPMENT
30. All tests must be performed with a DSX Fluke Versiv Cable Certifier.
31. All copper testing ([Category 5e and] Category 6A) must be completed using a DSX Cable Analyzer.
32. All fiber testing must be completed either with an OptiFiber Pro OTDR or a CertiFiber Pro Optical Loss Test Set. Confirm with LANL ISD-TS as to which fiber test equipment is required prior to commencing testing.
33. TELECOMMUNICATIONS ENCLOSURES (TE)/ RACKS
34. Floor Mount Rack
35. Floor mounted two-post racks 7 feet H x 19 inch W must be from one of the following manufacturers or an approved equivalent: AXIS, Belden, Chatsworth, CommScope, Cooper B-Line, or Panduit. All equipment rails must have threaded #12-24 mounting holes.
36. Floor mounted four-post racks 7 feet H x 29 inch W x 32 inch D must be from one of the following manufacturers or an approved equivalent: Chatsworth, CommScope, EDP, Great Lakes, or Panduit. All equipment rails must have threaded #12-24 mounting holes.
37. Between-the-rack cable management must be 12-inch-wide double-sided vertical management or, 10-inch-wide double-sided vertical management. Confirm with LANL ISD-TS as to which is required. Vertical cable managers must be the same manufacturer as the racks or cabinets.
38. End-of-rack management must be SYSTIMAX 6-inch double-sided vertical cable management or, 8-inch-wide double-sided vertical management. Confirm with LANL ISD-TS as to which is required. Vertical cable managers must be the same manufacturer as the racks or cabinets.
39. Racks must be secured to the floor.
40. Racks must contain adequate horizontal cable management to accommodate all patch cords.
41. Wall Mount Racks and Cabinets
42. Wall mounted racks 24 inch H x 24 inch W x 30 inch D must be from one of the following manufacturers or an approved equivalent: Hoffman.
43. Wall mounted racks 36 inch H x 24 inch W x 30 inch D must be from one of the following manufacturers or an approved equivalent: Hoffman.
44. Wall mounted racks 48 inch H x 24 inch W x 30 inch D must be from one of the following manufacturers or an approved equivalent: Hoffman.
45. Floor Mount Cabinets
46. Floor mounted cabinets 7 feet H x 29 inch W x 40 inch D must be from one of the following manufacturers or an approved equivalent: EDP. Cabinets must have locking doors and side panels unless otherwise noted.
47. Wall Mount Shrouds
48. Wall mounted shroud 32 inch H x 24 inch W x 12 inch D (6RU) must be from one of the following manufacturers or an approved equivalent: Hoffman.
49. Wall mounted shroud 32 inch H x 24 inch W x 6 inch D (3RU) must be from one of the following manufacturers or an approved equivalent: Hoffman.
50. FIBER OPTIC ENCLOSURES
51. Fiber Optic Shelves
52. Standard Density 1U sliding panel, accepts (2) 12 Port LC splice cassettes, modules, or panels. Corning CCH-01U
53. Standard Density 2U sliding panel, accepts (4) 12 Port LC splice cassettes, modules, or panels. Corning CCH-02U
54. Standard Density 4U sliding panel, accepts (12) 12 Port LC splice cassettes, modules, or panels. Corning CCH-04U.
55. Fiber Optic Adapter Panels
56. Closet Connector Housing (CCH) panel, duplex, 12 F, 62.5-micron multimode fiber (OM1) – CCH-CP12-A8
57. Closet Connector Housing (CCH) panel, duplex, 12 F, 50-micron multimode fiber (OM3/OM4) – CCH-CP12-E4
58. Closet Connector Housing (CCH) panel, duplex, UPC, 12 F, single-mode fiber (OS2) – CCH-CP12-A9.
59. DATA AND VOICE PATCH PANELS
60. [Category 5e Patch Panels
61. Category 5e solution, 24 port, high density patch panel must be ADC, 6653 1 585-24
62. Category 5e solution, 48 port, high density patch panel must be ADC, 6653 1 585-48.]
63. Category 6A Patch Panels
64. Category 6A solution, 24 port, high density patch panel must be SYSTIMAX, 760152587, 360-IPR-1100-E-GS6-1U-24
65. Category 6A solution, 48 port, high density patch panel must be SYSTIMAX, 760152595, 360-IPR-1100-E-GS6-2U-48.
66. CABLE SUPPORTS AND MANAGEMENT
67. Cable hangers must be open-top cable supports (J-Supports), 2 inch diameter loop.
68. Vertical Cable Management
69. All vertical cable managers shall be by the same manufacturer as the racks or cabinets as noted in Article [2.9] *Telecommunications Enclosures (TE)/Racks*
70. Distribution Cable Tray
71. Provide wire basket cable tray of types and sizes indicated with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. construct units with rounded edges and smooth surfaces; in compliance with applicable standards.
72. Refer to Section 26 0536, *Cable Trays for Electrical Systems*, for material and finish.
73. Description:
74. Color: Silver or Black
75. Size: As indicated on drawings
76. UL Listed wire basket cable tray.
77. LADDER RACK
78. 12 inch, 18 inch and 24 inch wide cable ladder rack sections must be manufactured by the following manufacturers or an approved equivalent: Chatsworth, Part Number: 11275-712, 11275-718 and 11275-724.
79. Description: Open rung UL listed ladder type cable tray with runway dropouts, complete with splice hardware, runway termination hardware, and 5/8-inch ceiling support hardware. Constructed of steel tubing with 9-inch rung spacing.
80. Color: Black
81. Size: As indicated on drawings
82. Cross-members welded at 9 inch intervals
83. UL Listed ladder type cable tray.
84. Accessory Products:
85. Radius drop-cross member, radius drop-stringer, junction splice kit, butt splice kit, wall angle support kit, end closing kit, protective end caps, 6 inch cable runway elevation kit, cable runway moveable cross member as needed and specified on the drawings.
86. Provide any accessory products related to the wire management components to provide a complete and functional infrastructure system.
87. All splice and connection kits must be UL Listed.
88. FIBER OPTIC BUILDING BACKBONE CABLE
89. Multimode Fiber Optic
90. Primary fiber optic building backbone system infrastructure must consist of one (1), 12 strand, multimode OM3 50-micron, Plenum rated OFNP, Corning Part Number 012T88-33180-29, or Riser Rated, OFNR, Corning Part Number 012T81-33180-24 depending on pathway. Coordinate cable rating (plenum or riser) with LANL ISD-TS.
91. Legacy fiber optic building backbone system infrastructure must consist of one (1), 12 strand, multimode 62.5/125-micron, Plenum rated OFNP, Corning Part Number 012K88-33130-29 or Riser Rated, Corning Part Number 012K8F-31130-29 depending on pathway. Coordinate cabling (plenum or riser) with LANL ISD-TS.
92. Single-mode Fiber Optic
93. Future/high bandwidth fiber optic building backbone system infrastructure must consist of one (1), 12 strand, single-mode 8.3/125 OFNP Corning Part Number 012E88-33131-29 or OFNR Corning Part Number 012E81-33131-24, depending on pathway. Coordinate cable rating (plenum or riser) with LANL ISD-TS.
94. Composite Armored Fiber Optic Cable
95. Armored cable may be used in lieu of an inner-duct system where approved by LANL ISD-TS. All part numbers are subject to LANL approval.
96. FIBER OPTIC CAMPUS BACKBONE CABLE
97. Multimode Fiber Optic
98. Legacy fiber optic campus backbone system infrastructure must consist of a minimum of one (1), 12 strand, multimode 62.5/125-micron, Riser Rated, Corning Part Number 012KU4-T4730D20 depending on pathway. Coordinate strand count with LANL ISD-TS.
99. Single-mode Fiber Optic
100. High bandwidth fiber optic campus backbone system infrastructure must consist of a minimum one (1), 12 strand, single-mode 8.3/125 OFNR Corning Part Number 012ZU4-T4F22D20, depending on pathway. Coordinate strand counts with LANL ISD-TS.
101. HORIZONTAL CABLE
102. [Where Category 5e+ horizontal cabling is specified by the drawings; Category 5e+ horizontal cable utilized for the distribution of communications must be 4 pair, 24 AWG, plenum, Category 5e+ Belden, Part number 1701A.]
103. Where Category 6A horizontal cabling is specified by the drawings; Category 6A cabling utilized for the distribution of communications must be (GigaSPEED X10D), SYSTIMAX Part number 2091B GRN C6A 4/23 W1000, Material ID 760107219, WE TOTE box, or Part number 2091B GRN C6A 4/23 R1000 Material ID 760105890, REEL.
104. Unless otherwise noted, the horizontal cable, homerun to/from each communication port must be blue in color (jacket). All wireless cabling must be orange in color. All fire alarm cabling must be red in color.
105. Coordinate cable type for each project with LANL ISD-TS.
106. WIRELESS ACCESS POINTS
107. Provide, install, and test (2) Category 6A M-series data modular inserts, coiled inside 4 inch electrical back-box with single gang flat reducer ring. No faceplate must be used for wireless access point outlets.
108. Install wireless access point bracket, provided by LANL ISD-TS, over electrical back box.
109. FIBER OPTIC TERMINATION HARDWARE
110. Fiber Optic Connectors – LC Connector Type
111. 62.5µm MM Fiber Optic connector (for legacy re-termination projects) – Corning field installable Multi-mode FUSELite™ Fusion-Spliced connector. Part number SOC-LCU-900-OM1.
112. 50µm MM Fiber Optic connector (for legacy re-termination projects) – Corning field installable Multi-mode FUSELite™ Fusion-Spliced connector. Part number SOC-LC-900-OM4.
113. Single-Mode Fiber Optic connector (for all new projects) – Corning field installable Single-mode FUSELite™ Fusion-Spliced connector. Part number SOC-LCU-900-SM.
114. Splice Cassettes for Corning Standard Density Fiber Enclosures
115. Single-mode or OM3/OM4 50 Micron Splicing cassette, 12LC, Corning Part number CCH-CS24-E4-P00TE.
116. FACE PLATES
117. [Category 5e Faceplates – Wall or Flush Mounted
118. Single gang 2-port faceplates must be CommScope NETCONNECT Part number 1-2111009-3.
119. Single gang 4-Port faceplates must be CommScope NETCONNECT Part number 1-2111011-3.
120. Single gang 6-port faceplate must be CommScope NETCONNECT Part number 1-2111012-3.]
121. Category 6A Faceplates – Wall or Flush Mounted
122. Single gang 2-port faceplates must be SYSTIMAX Part number M12L-262 Material ID 108168469
123. Single gang 4-Port faceplates must be SYSTIMAX Part number M14L-262, Material ID 108168543
124. Single gang 6-port faceplate must be SYSTIMAX Part number M16L-262, Material ID 108168584.
125. Wall Telephone Face Place
126. Single gang faceplates must be Stainless SYSTIMAX Part number M11SP-L, Material ID 7600720074.
127. MODULAR INSERTS
128. Use a single modular insert for data communication ports, 8 position, 8 conductor, non-keyed, Category 6A (GigaSPEED X10D), Gray, SYSTIMAX Part number MGS600- 318, Material ID 760092452 in the first position. Where noted on the drawings, provide Category 6A SYSTIMAX Part number MGS600-262, Material ID 760092429.
129. Blank inserts must be SYSTIMAX Part number M20AP-262, Material ID 107067928, or must match faceplate color.
130. HYDRA CABLES
131. [Where Category 5e+ horizontal cabling is specified by the drawings: Category 5e+ hydra cables utilized for the connection of the patch panel to the switch must be Part number RJ45X12DT350.]
132. Where Category 6A horizontal cabling is specified by the drawings: Category 6A hydra cables utilized for the connection of the patch panel to the switch must be Part number XLANL-12-C6A-1S1N-6F.

PART 3 EXECUTION

1. GENERAL
2. Subcontractor must use cable tray as primary cable pathway and must distribute from the cable tray to each work Area Outlet (WAO) via conduit or acceptable methods. See drawings for cable tray and pathway routing.
3. All penetrations, cores, and sleeves must be provided by the Subcontractor with installation practices adhering to local codes and industry accepted methodology.
4. Firestop penetration seals must be provided by Telecommunications Installer using methods and materials which are FM-approved and UL-listed as applicable and approved by the AHJ and per Section 07 8400, *Firestopping*. During the construction phase, fire-stopping pillows are required when it is necessary to temporarily firestop a penetration. If pillows are approved as a permanent solution by the Fire Marshal, they may remain as a permanent firestop. If pillows are not approved as a permanent solution, Telecommunications Subcontractor shall seal all telecommunications penetrations with an approved firestopping solution.
5. Subcontractor must provide, install or replace pull string in all conduits and innerducts to allow future access for pulling cables through existing conduit.
6. Materials and workmanship:
   * + 1. Work must be executed in a professional manner and must present as neat, plumb, and perpendicular to building structure and parallel to electronic devices and cabling. Mechanical appearance when completed must adhere to the standards in this Section. Maintain maximum clearance between telecommunications materials and other engineered systems per this Section or drawings. Do not run work exposed unless shown exposed on drawings.
       2. Material and equipment must be new and installed according to manufacturer’s recommended best practice so that completed installation must operate neatly, safely, and efficiently.
       3. Completely remove temporary materials, facilities, and equipment when their use is no longer required. Clean and repair damage caused by temporary installations.
       4. Subcontractor must ensure that excess materials are removed from the job site upon completion and acceptance of project work. Excess materials removed from the job site must be credited to LANL. Additionally, upon completion of the project, all Subcontractor equipment will be removed.
       5. Work area must be kept clean and free of hazards.
       6. All telecommunication outlets must comply with T568-B wiring configuration.
7. CABLE REMOVAL
8. NEC Article 770.25 for optical fiber and Article 800.25 for communications cabling state that all accessible abandoned cable, unless marked for future use, must be removed.
9. The Subcontractor is responsible for removing old, abandoned telecommunications cabling. LANL ISD-TS is available to help coordinate this effort.
10. GROUNDING AND BONDING INSTALLATION
11. All telecommunications devices must be grounded/bonded to the SBB using minimum solid 6 copper (AWG wire) with green insulation. The size of the grounding conductor is dependent upon the length of the conductor and must be coordinated with LANL ISD-TS. Coordinate exact grounding locations for each component with the Electrical Installer.
12. Grounding and bonding conductors must not be placed in ferrous metallic conduit.
13. PATHWAYS INSTALLATION
14. Coordinate all pathways and raceways with LANL ISD-TS.
15. Provide a continuous woven polyester pull tape (1,200-lb. test) with stamped footage markings pulled into each telecommunications backbone and entrance conduit pathway and all innerduct. Tie off the pull tape at each end.
16. Provide white tape or paint on conduits at intervals not to exceed 10 feet where possible and in change of direction to identify unclassified (yellow) interior telecommunications routes for all new and legacy installations.
17. Identification of horizontal pathways must be coordinated with LANL ISD-TS. Use materials and installations methods described in Section 26 0553, *Identification for Electrical Systems* and this Section.
18. For retrofit of pathways for horizontal cables in existing buildings, use materials and installation methods that comply with the NEC and LANL ESM Chapter 19.
19. Provide conduit pathway systems that meet NEC requirements and the following:
20. Conduit runs must have no more than 100 feet between pull boxes.
21. The maximum conduit fill must be no more than 40%.
22. Conduit runs must have no more than 180 degrees of bends between pull boxes.
23. Provide a pull box before any reverse bend.
24. Pull boxes must not be used in lieu of a bend.
25. All pull boxes must be labeled with “Communications” with a mechanically generated label.
26. For conduits 2 inches and smaller the inside radius of the conduit bends must not be less than 6 inches the internal diameter of a conduit.
27. For conduits larger than 2 inches the inside radius of the conduit bends must not be less than 10 times the internal diameter of the conduit.
28. Cable tray systems may be used for buildings that are < 2000 sq. ft. with the same criteria as listed below:
29. Limit cable tray initial total fill to 50%.
30. Calculate cable tray size to accommodate 100% future growth.
31. A minimum of 12 inches of accessible clearance is required both above and to one side of all telecommunications cable trays. Coordinate cable tray routing with other trades during the production of shop drawings to ensure this requirement is met. Any conflicts that cannot be resolved during this coordination must be brought to the attention of LANL ISD-TS.
32. Cabling systems other than telecommunications, security, or audio visual must not be installed in telecommunications cable tray.
33. Provide UL Listed bonding couplings in the cable tray system.
34. Refer to Section 26 0536, *Cable Trays for Electrical Systems*, for materials and installation methods.
35. Provide the following minimum separation distances between telecommunications cabling and possible sources of EMI as shown in the table below. If these minimum clearances are not feasible, provide galvanized rigid steel conduit, intermediate metallic conduit (IMC), or similar raceway that will provide effective shielding.

|  |  |  |  |
| --- | --- | --- | --- |
| **Minimum Separation Distances per ANSI/TIA-569 between Data cables and Potential Sources of EMI** | | | |
| **Condition** | **Minimum Separation Distance** | | |
| < 2 kVA | 2– 5 kVA | > 5 kVA |
| Unshielded power lines or electrical equipment in proximity to open or nonmetal data cable pathways | 5 inches | 12 inches | 24 inches |
| Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway | 2.5 inches | 6 inches | 12 inches |
| Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway | N/A | 3 inches | 6 inches |
| Electrical Motors or Transformers | N/A | N/A | 48 inches |

1. CONDUIT FILL RATIO CHART
2. The table below shows the conduit fill ratio for Category 6A cabling based on the area and the minimum bend radius. Apply these fill percentages to straight runs with nominal offsets equivalent to no more than two 90-degree bends.
3. Category 6A UTP (0.265 inch OD) 40% cable fill ratio for EMT conduit:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trade Size**  **(inch)** | **Conduit I.D. (inch)** | **Conduit Area (in2)** | **Fill Area (in2)** | **Number of cables** |
| 1 | 1.049 | 0.86 | 0.35 | 5 |
| 1-1/4 | 1.380 | 1.49 | 0.60 | 9 |
| 1-1/2 | 1.610 | 2.03 | 0.81 | 12 |
| 2 | 2.067 | 3.35 | 1.34 | 21 |
| 2-1/2 | 2.731 | 5.85 | 2.34 | 36 |
| 3 | 3.356 | 8.84 | 3.54 | 55 |
| 3-1/2 | 3.834 | 11.54 | 4.62 | 72 |
| 4 | 4.334 | 14.75 | 5.90 | 92 |

1. LABELING AND IDENTIFICATION
2. Provide labeling as required.
3. Confirm labeling scheme with LANL ISD-TS prior to labeling any patch panels or outlets.
4. Provide and install labeling at the wall outlet according to LANL ISD-TS provided labeling scheme noted in Appendix A for *Standard Jack Labeling*.
5. All locations shall be clearly marked with a machine-made label with a unique identifying number at both the station location and the TR location. Cabling will also have jack labeling at both the station location and the TR location.
6. Communications and data conduit are to be clearly identified, at every junction box, via a painted section or by use of conduit stickers indicating each conduit run. Unless otherwise noted, blue must be used for telecom ports.
7. CABLE TESTING
8. All cables (UTP, ScTP, FTP, or Fiber Optic) must be tested as noted below.
9. All testing must be completed after all communication face plates, patch panels, fiber optic termination hardware and wiring blocks have been secured in their final position s and are properly labeled per this Section. The permanent link of the cabling must be tested. This includes the cabling from the patch panel to the telecommunications outlet or from patch panel to patch panel. It does not include patch cords. The only exception to permanent link testing is when new Category 5e Hydra cables are terminated on Hi-8 blocks as part of the scope of work. When this occurs, a channel test is required that includes Hydra cable.
10. Building must be operational (i.e., Building lighting and power must be energized).
11. Provide LANL ISD-TS with all test results/records in native and electronic file format (pdf) representing each MCR and TR containing the following documentation. Testing and Documentation must include but not limited to:
12. Fiber Optic Cables
13. Using an optical loss test set or OTDR, measure end-to-end attenuation for all installed cables, including: all splices, terminated fiber; all connector, and patch panels. The total loss must be measured and reported for each cable at the appropriate operation wavelengths, 850 nm and 1300 nm for multimode fiber and 1310 nm and 1550 nm for single-mode fiber. Optical attenuation measurements are to be done from one direction.
14. Multimode Link Measurement:
15. Test at 850 and 1300 nm in both directions according to ANSI/TIA- 526-14, Method B, One Reference Jumper.
16. Before beginning testing, the Subcontractor must ensure that tester is calibrated for the fiber type and manufacturer being used on the project. Note that these settings must not be altered once set without sufficient justification. When tested at both wavelengths in both directions, the measured attenuation of each fiber optic cable segment must be less than or equal to the design attenuation of the segment being tested. Until this condition has been met, the installation must not be considered complete, and shall not be accepted.
17. The loss across a multimode fiber connector pair must not exceed 0.6 dB of loss per mated pair plus 0.1 dB loss per 100 feet of fiber cable length.
18. Single-Mode Link Measurement:
19. Test at 1310 nm and 1550 nm in both directions according to ANSI/TIA-526-7, Method A.1, One Reference Jumper.
20. Each element of all new single-mode fiber optic cabling must be tested for continuity and attenuation in both directions at both 1310 and 1550 µm, with a fiber optic light source and power meter. Before beginning testing, the Subcontractor must ensure that tester is calibrated for the fiber type and manufacturer being used on the project. Note that these settings must not be altered once set without sufficient justification. When tested at both windows in both directions, the measured attenuation of each fiber optic cable segment must be less than or equal to the design attenuation of the segment being tested. Until this condition has been met, the installation must not be considered complete, and shall not be accepted.
21. The loss across a single-mode fiber connector pair shall not exceed 0.5 dB per mated pair plus 0.03 dB loss per 100 feet of fiber cable length.
22. When testing with an OTDR, test with launch and tail cords.
23. [Horizontal Cabling System - Category 5e
24. Wire map continuity
25. Length
26. Link Insertion Loss Less than 31.0 dB @ 250 MHz
27. Link NEXT/FEXT Pr. To Pr. greater than 38.3 dB @ 250 MHz
28. Link NEXT/FEXT PWR. greater than sum 32.7 dB @ 250 MHz
29. Link ELFEXT Pr. To Pr. 16.2 dB @ 250 MHz
30. Link ELFEXT PWR. Greater than sum 13.2 dB @ 250 MHz
31. Return loss 10.0 dB @ 250 MHz.]
32. Horizontal Cabling - Category 6A
33. Wire map continuity
34. Length
35. Link Insertion Loss Less than 43.8 dB @ 500 MHz
36. Link NEXT/FEXT Pr. To Pr. greater than 26.7 dB @ 500 MHz
37. Link PsumNEXT greater than sum 23.8 dB @ 500 MHz
38. Link ACRF 10.2 dB @ 500 MHz
39. Link PsumACRF Greater than sum 7.2 dB @ 500 MHz
40. Return loss 8.0 dB @ 500 MHz.
41. To accomplish/facilitate complete Category [5e/]6A Link testing, Telecommunication Installer must utilize a Level IIIe accuracy cable tester with the manufacturer’s latest version of firmware software. The Subcontractor must use the same model of for all test gear from the same manufacturer for this project.
42. Installer to coordinate with test equipment manufacturer for exact test procedures for SYSTIMAX Link testing.
43. Save all test records for [Category 5e and] Category 6A cabling in both tabular and graphical format.
44. Any cabling (copper or fiber) with a failure or a marginal pass must be repaired or replaced and retested until a passing test result is obtained. No failed or marginal pass result will be accepted.
45. TELECOMMUNICATIONS ENCLOSURES/RACKS INSTALLATION
46. Each rack must house equipment and devices of the following in various quantities:
47. Fiber optic termination hardware.
48. Fiber optic management panels.
49. Electronic equipment provided by others (coordinate with LANL ISD-TS).
50. Communications patch panels (voice and data).
51. Horizontal and vertical cable management panels.
52. Provide and install quantity of racks to house the equipment and devices plus 20 percent additional space for field changes and future expansion.
53. All racks must be secured to the floor using the factory recommended hardware and installation practices.
54. All racks must be properly grounded, conforming to ANSI/TIA-607, NEC and all related grounding standards and codes.
55. Install cable racks in accordance with NFPA 70, Article 318 requirements and as specified herein.
56. At a minimum, provide 3 feet of clearance to the front and rear of each row of equipment racks and/or cabinets. Whenever permissible, provide a 3-foot clearance on three sides of each row of equipment racks and/or cabinets. For wall-mounted equipment, provide 3 feet of clearance to the front of the equipment.
57. FIBER OPTIC ENCLOSURES INSTALLATION
58. Provide and install quantity of empty fiber panels and adapters to terminate all fiber cables distributing from each TR, plus 20% growth.
59. Coordinate with LANL ISD-TS for exact location of panels within each equipment rack prior to installation.
60. DATA AND VOICE PATCH PANELS INSTALLATION
61. Provide and install quantity of empty data patch panels and modular inserts to terminate all horizontal data cables distributing from each TR, plus 20% growth.
62. All [Category 5e/]Category 6A cables are to be terminated on the patch panels. The cables are to be cut down numerically in ascending order starting from the upper left port (left to right, top to bottom).
63. Coordinate with LANL ISD-TS for exact location of panels within each equipment rack prior to installation .
64. Subcontractor to provide as-built sheet, laminated and hung in MCR/TR room on the wall, showing riser pair correlation with horizontal jack numbers for every outlet.
65. CABLE SUPPORTS AND MANAGEMENT INSTALLATION
66. J-Hook supports must be installed in accordance with the manufacturer’s recommendations and located at intervals such that the cables do not rest on ceiling tile or grid at any point along the pathway.
67. Cable management straps must be hook and loop (i.e., Velcro®). Nylon cable ties must not be used.
68. Generally, cable pathways are provided by an Electrical Installer. The pathways must be parallel to building lines and must sweep/turn at 90-degree angles maintaining minimum bend radius for cable and will comply with the guidelines and recommendations outlined in ANSI/TIA-568 and ANSI/TIA-569.
69. Provide cable and supports as required. All cables must be supported.
70. Where cable tray, ladder rack and conduit are not provided for support of the telecommunication cables, provide J-hooks or other LANL ISD-TS approved non-continuous cable support at intervals not to exceed 5 feet.
71. Cable supports must not be supported from the ceiling structure, mechanical, electrical, fire protection, or plumbing devices.
72. Where metal conduit is provided by Electrical Subcontractor for use by the Telecommunications Installer, provide each end of the conduit with plastic bushings for cable sheath protection.
73. Provide all strain relief for the purpose of maintaining bend radius and providing additional protection/support of exposed cables.
74. At all equipment racks, provide Velcro straps at 1-foot intervals for support of cables.
75. Provide and install cable management and support as required. Refer to drawings and details for location and quantity of horizontal cable management.
76. Provide and install vertical cable management on equipment rack.
77. Provide and install D-rings for custom cabinet, mount three rows of five D- rings (per row). Refer to drawing details for additional information.
78. Provide, install and ground wire basket cable tray.
79. Install wire basket cable tray in accordance with NEMA BI-50016. All wire basket cable tray components must be properly grounded conforming to ANSI/TIA-607 and this Section.
80. LADDER RACK INSTALLATION
81. Provide, install, and ground ladder rack in the MCR and TR.
82. All ladder rack components must be properly grounded conforming to ANSI/TIA- 607 and this Section.
83. FIBER OPTIC BUILDING BACKBONE CABLE INSTALLATION
84. Unless otherwise noted, provide, install, terminate, and test one (1) 12-strand multimode fiber optic cable from the MCR to each TR.
85. Unless otherwise noted, provide, install, terminate, and test one (1) 12-strand single-mode fiber optic cable from the MCR to each TR.
86. Fiber to fiber splicing shall not be permitted where a continuous length of cable would otherwise be installed.
87. Fiber optic splicing requires approval from LANL ISD-TS.
88. Coordinate pathways, and cable rating (plenum or riser) with LANL ISD-TS, Electrical engineer, and Fire Marshal. The pathways and spaces shall determine the cable rating (plenum & riser).
89. Armored hybrid Fiber Optic may be used with the approval of LANL ISD-TS.
90. FIBER OPTIC CAMPUS BACKBONE CABLE INSTALLATION
91. Provide, install, test, and terminate the size, quantity, and strand count of fiber cable noted on the drawings.
92. Fiber to fiber splicing shall not be permitted where a continuous length of cable would otherwise be installed.
93. Fiber optic splicing requires approval from LANL ISD-TS.
94. Coordinate pathways, and cable rating (plenum or riser) with LANL ISD-TS, Electrical engineer, and Fire Marshal. The pathways and spaces shall determine the cable rating (plenum & riser).
95. Armored hybrid Fiber Optic may be used with the approval of LANL ISD-TS.
96. HORIZONTAL CABLE INSTALLATION
97. Provide, install, terminate, and test all horizontal data cables shown on the drawings from each modular insert to its corresponding patch panel.
98. All four pairs of each horizontal cable must be terminated at both ends.
99. One end of the horizontal cable must be terminated in an 8 position, 8 conductor T568-B wired modular insert at the communications outlet.
100. The other end of the horizontal cable must be terminated in an 8 position, 8 conductor T568-B wired modular insert in the SYSTIMAX Patch Panel.
101. Coordinate exact panel or block location with LANL ISD-TS prior to installation.
102. All horizontal cables must be terminated in sequential order in accordance to LANL ISD-TS specified labeling scheme as indicated in this Section.
103. All modular inserts must be colored as follows: blue for a typical data outlet, orange for wireless, red for fire alarm.
104. Provide and install wire and cable in approved/ provided raceways and cable tray as specified and as approved by the AHJ.
105. Cable Pulling - Pulling Tension: Maximum-pulling tensions for 4-pair horizontal UTP cable must not exceed 110N (25 lbf).
106. Maintain cable twist to within ½ inch of the main point of insulation displacement contact.
107. When stripping cable for termination, remove only a minimum amount (i.e., as little as possible) of cable jacket insulation.
108. Additional cable slack (service loop) may be considered at both ends for maintenance or future cabling system changes:
109. Telecommunication Room Loop = 10 feet (Looped in a figure 8)
110. Telecommunications Outlet = 1 foot typical; 6 feet for wireless telecommunications outlet
111. Splices are not permitted for any horizontal cabling.
112. No horizontal cable run must exceed 295 feet (including a minimum of 20 feet for slack and service loop).
113. Never use staples to install telecommunications cabling.
114. Horizontal cabling MUST NOT be installed near fluorescent lamps, high-voltage sources, electrical motors, or other source of interference.
115. To avoid electromagnetic interference, all distribution should provide clearance of at least:
116. Four (4) feet from large motors and/or transformers
117. One (1) foot from conduit and cables used for electrical distribution
118. Five (5) inch from fluorescent lighting
119. Refer to ANSI/TIA-568, ANSI/TIA-569 and NFPA 70 for additional cable clearance.
120. Horizontal distribution pathways should cross perpendicular to fluorescent lighting and electrical power cables and conduits
121. FIBER OPTIC TERMINATION HARDWARE INSTALLATION
122. Provide and install termination hardware to support all fiber optic cables installed.
123. Provide and install fiber optic coupler panels required to terminate all installed fiber optic backbone cable(s).
124. Provide, install, and test quantity of fiber optic termination hardware to terminate all fiber optic strands of fiber optic backbone cable.
125. Coordinate with LANL ISD-TS for exact location on wall field.
126. FACE PLATES INSTALLATION
127. Provide and install all communication faceplates, label, and raceway inserts. All outlet locations must comply with Americans with Disabilities Act (ADA) Accessibility Guidelines, 28 CFR Part 36, Appendix A.
128. Unless otherwise noted, telecommunications outlets shall be mounted with the center of the outlet at 18 inches above finished floor.
129. Where telecommunications outlets are to be installed in hard wall-enclosed offices, outlets must be mounted with the center of the outlet at 7 inches above finished floor (immediately above the cove base). Coordinate outlet locations with modular furniture and associated hangers to ensure that all outlets are accessible.
130. Where telecommunications outlets are to be installed at laboratory benches and counters, coordinate mounting height with architectural details. The maximum outlet height to meet ADA requirements is 44 inches.
131. All telecommunications outlets must be located within 3 feet of a suitable electrical power outlet. Coordinate outlet locations with Electrical Subcontractor.
132. WALL TELEPHONE FACE PLATES INSTALLATION
133. Provide and install all telephone faceplates.
134. Wall phone must be mounted at 48 inches above finished floor to the center of the outlet for ADA requirements. Verify final mounting heights with architect before installation.
135. MODULAR INSERTS INSTALLATION
136. Provide and install [Category 5e/]Category 6A modular inserts.
137. Provide and install blank inserts in all empty ports in faceplates.
138. HYDRA CABLES INSTALLATION
139. The connection of the hydra cabling to the network switches will be done by LANL NOC. Coordinate with LANL NOC at least three weeks prior to installation of the hydra cables.

END OF MAIN SECTION [; APPENDICES FOLLOW]

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Do not delete the following reference information:

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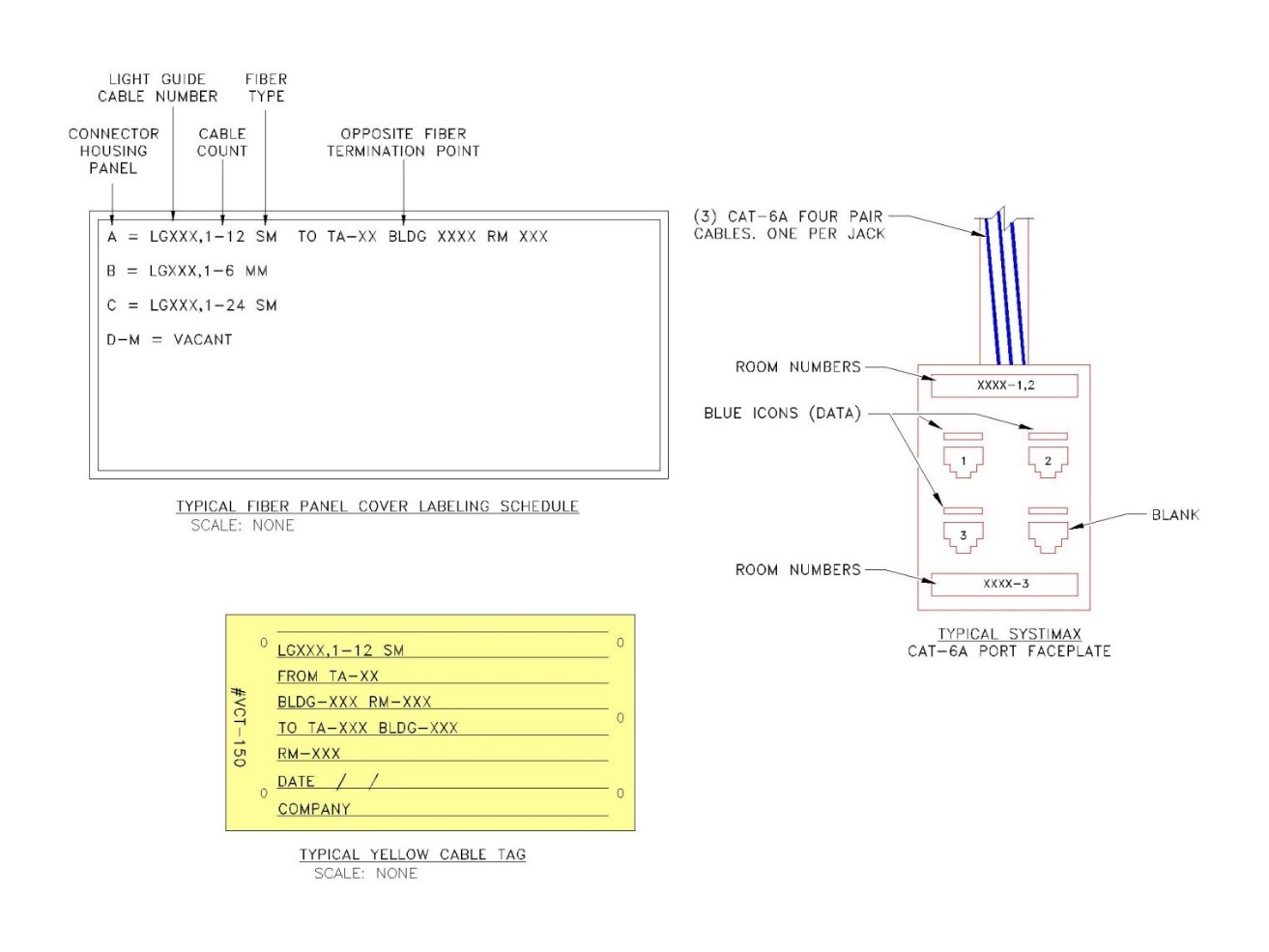
THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 27 1000 Rev. 10, dated February 4, 2025.

**Appendix A - Diagrams**

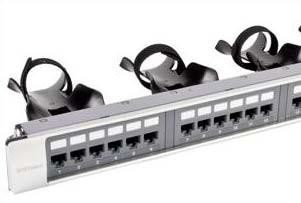
* + - 1. Diagram

         Description automatically generatedCabling Distribution: The diagram provided below is intended as an example of a typical distribution method and shall not be used for the purposes of cost estimation or shop drawings.
      2. LANL ISD-TS Standard Jack Labeling



* + - 1. Diagram

         Description automatically generatedPatch panel desi strip



2001-B

2001-D1-B

* + - 1. Diagram

         Description automatically generated568B Jack Pinout

**Appendix B – LANL ISD-TS Specified Product List**

| **Material ID** | **Part Number** | **Description** | **Spec Section Location** |
| --- | --- | --- | --- |
| **Copper Products** | | | |
| **Cable** | | | |
| 760107219 | 2091B GRN C6A 4/23 W1000 | GigaSPEED X10D® 2091B ETL Verified Category 6A U/UTP Cable, green jacket, 4 pair count, 1000 ft length, WE TOTE® box | Category 6A Horizontal Data Cable |
| 760107276 | 2091B YEL C6A  4/23 W1000 | GigaSPEED X10D® 2091B ETL Verified Category 6A U/UTP Cable, yellow jacket, 4 pair count, 1000 ft length, WE TOTE® box | Category 6A Horizontal Voice Cable |
| 107766057 | 2010B WH  100/24 R1000 | 2010B Category 3 U/UTP Cable, plenum, white jacket, 100 pair count, 1000 ft length, reel | Copper Building Backbone Cable |
| 9-57315-1 | 1010A SLT C3  100/24 R1000 | 1010A Category 3 U/UTP Cable, riser, gray jacket, 100 pair count, 1000 ft length, reel | Copper Building Backbone Cable |
| **Copper Patch Panels** | | | |
| 760152587 | 360-IPR-1100- E-GS6-1U-24 | SYSTIMAX 360™ GigaSPEED X10D®  1100GS6 Evolve Category 6A U/UTP Patch Panel, 24 port | Data/Voice Patch Panels |
| 760152595 | 360-IPR-1100- E-GS6-2U-48 | SYSTIMAX 360™ GigaSPEED X10D®  1100GS6 Evolve Category 6A U/UTP Patch Panel, 48 port | Data/Voice Patch Panels |
| 760102251 | 360-PM-GS6-  2U-24 | SYSTIMAX 360™ GigaSPEED X10D®  PATCHMAX® GS6 Category 6A U/UTP Patch Panel, 24 port | Wall Mount Data/Voice Patch Panel |
| 760128207 | 360-PM-GS6-  2U-48 | SYSTIMAX 360™ GigaSPEED X10D®  PATCHMAX® GS6 Category 6A U/UTP Patch Panel, 48 port | Wall Mount Data/Voice Patch Panel |
| **Modular Inserts/Jacks** | | | |
| 760092429 | MGS600-262 | GigaSPEED X10D® MGS600 Series Category 6A Information Outlet, white | Category 6A Voice Modular Insert |
| 760092437 | MGS600-270 | GigaSPEED X10D® MGS600 Series Information Outlet, gray | Category 6A Data Modular Insert |
| 760092361 | MGS600-003 | GigaSPEED X10D® MGS600 Series Information Outlet, black | Category 6A Data Modular Insert |
| **Patch Cords** | | | |
| CO199K2- XX | MiNo6A-XX | CommScope Category 6A MiNo6A Series 28AWG Solid Cordage Modular Patch Cord | UTP Line/Patch Cables |
| CPC3482- XX | GS8E117-S-XX | GigaSPEED XL® GS8E Single End Solid Cable Modular Patch Cord | UTP Line/Patch Cables (110 wall-field to PP) |
| **Faceplates** | | | |
| 106622251 | M106FR2-262 | M106 Flush Mounted Modular Mounting Frame, two port white | Floor Boxes |
| 106622285 | M106FR4-262 | M106 Flush Mounted Modular Mounting Frame, four port white | Floor Boxes |
| 108258427 | M10L-262 | L Type Flush Mounted Faceplate, one port white | Faceplates |
| 108168469 | M12L-262 | L Type Flush Mounted Faceplate, two port white | Faceplates |
| 108168501 | M13L-262 | L Type Flush Mounted Faceplate, three port white | Faceplates |
| 108168543 | M14L-262 | L Type Flush Mounted Faceplate, four port white | Faceplates |
| 108168584 | M16L-262 | L Type Flush Mounted Faceplate, six port white | Faceplates |
| 760117572 | M10LWSP | Wall Mount Telephone, one port Stainless | Faceplates |
| 107067928 | M20AP-262 | M20 Dust Cover for M-Series Faceplates and Outlets, white | Faceplates |
| **Wall Mount** | | | |
| 558843-1 |  | 110Connect XC System Cross-Connect Wiring Block with Legs, Category 5e, 110 punch down, 300-pair | Voice Horizontal/Backbone Terminations for Voice Ext Blocks |
| 558842-1 |  | 110Connect XC System Cross-Connect Wiring Block with Legs, Category 5e, 110 punch down, 100-pair | Voice Horizontal/Backbone Terminations for Voice Ext Blocks |
| 558401-1 |  | 110Connect XC System Connector Block, 4-pair, PCB, 110 punch down, white | Voice Horiz/Backbone Terminations for Voice Ext Blocks |
| 1375354-1 |  | 110Connect XC System LABEL, PAPER,  0.5 inch high x 7.9 inch width, white matte | Voice Horiz/Backbone Terminations for Voice Ext Blocks |
| 558417-1 |  | 110Connect XC System Designation Strip | Voice Horiz/Backbone Terminations for Voice Ext Blocks |
| **Telecom Rooms** | | | |
| 760082479 | RK3-45A | Equipment Rack, 2-Post, 3 inch Channel x 7 feet H - 19 inch AIu (45U) 12-24 Tapped Rails, Black | Telecommunication Enclosures/Racks |
| 760082560 | RK4P45-36A | Equipment Rack, 4-Post, 36 inch D x 7 feet H - 19 inch Alu (45U) 12-24 Tapped Rails, Black | Telecommunication Enclosures/Racks |
| 760244782 | VCM-DS-84- 12B | Vertical Cable Management Kit, 12 inch X 84 inch Double Sided, With Doors, Black | Telecommunication Enclosures/Racks |
| 760244781 | VCM-DS-84- 10B | Vertical Cable Management Kit, 10 inch X 84 inch Double Sided, With Doors, Black | Telecommunication Enclosures/Racks |
| 760244780 | VCM-DS-84-8B | Vertical Cable Management Kit, 8 inch X 84 inch Double Sided, With Doors, Black | Telecommunication Enclosures/Racks |
| 760244779 | VCM-DS-84-6B | Vertical Cable Management Kit, 6 inch X 84 inch Double Sided, With Doors, Black | Telecommunication Enclosures/Racks |
|  | EZDP44S2 | STI Fire-stop Sleeves, Series 44+, 4 inch Single Pathway for through wall installations |  |
|  | EZDP144FKS2 | STI Fire-stop Sleeves, Series 44+, 4 inch Single Pathway for through floor installations |  |
|  | 11275-712 | Chatsworth 12 inch UL Listed Cable Runway | Communications cable management and ladder rack |
|  | 11275-718 | Chatsworth 18 inch UL Listed Cable Runway | Communications cable management and ladder rack |
|  | 11275-724 | Chatsworth 24 inch UL Listed Cable Runway | Communications cable management and ladder rack |
|  | 12100-718 | Chatsworth 17 inch Cable Runway Radius Drop for Cross-members | Communications cable management and ladder rack |
|  | 12100-712 | Chatsworth 11 in. Cable Runway Radius Drop for Cross-members | Communications cable management and ladder rack |
|  | 16301-701 | Chatsworth Butt-Splice Kit for 1-½ inch side stringers | Communications cable management and ladder rack |
|  | 12730-718 | Chatsworth 3 inch Channel Rack-to-Runway Mounted plate | Communications cable management and ladder rack |
| **Fiber Products** | | | |
| **Material ID** | **Part Number** | **Description** | **Spec Location** |
| **Cables** | | | |
| 700009731 | P-012-DS-5L- FSUAQ | LazrSPEED® OM3 Plenum Distribution Cable, 12 fiber single-unit | Fiber Backbone Cable |
| 700208150 | R-012-DS-5L- FSUAQ | LazrSPEED® OM3 Riser Distribution Cable, 12 fiber single-unit | Fiber Backbone Cable |
| 700009400 | P-012-DS-6F- FSUOR | OptiSPEED® OM1 Plenum Distribution Cable, 12 fiber single-unit | Fiber Backbone Cable (Legacy Only) |
| 700010168 | R-012-DS-6F- FSUOR | OptiSPEED® OM1 Riser Distribution Cable, 12 fiber single-unit | Fiber Backbone Cable (Legacy Only) |
| 760004358 | P-012-DS-8W- FSUYL | TeraSPEED® OS2 Plenum Distribution Cable, 12 fiber single-unit | Fiber Backbone Cable |
| 760004440 | R-012-DS-8W- FSUYL | TeraSPEED® OS2 Riser Distribution Cable, 12 fiber single-unit | Fiber Backbone Cable |
| 760175752 | P-024-DS-CM- FSUOR/8W012/ 6F012 | TeraSPEED® 12-fiber OS2/12-fiber OM1 Plenum Distribution Cable, 24 fiber single- unit | Fiber Backbone Cable (Legacy Only) |
| 760018754 | P-024-DS-CM- FSUAQ/8W012/ 5L012 | TeraSPEED® 12-fiber OS2/12-fiber OM3 Plenum Distribution Cable, 24 fiber single- unit | Fiber Backbone Cable |
| **Panels** | | | |
| 760231449 | SD-1U | Standard Density 1U sliding Panel, accepts  (3) LGX/1000 style splice cassettes, modules or panels, providing up to 36 duplex LC ports | Fiber Optic Enclosures |
| 760231456 | SD-2U | Standard Density 2U sliding Panel, accepts  (6) LGX/1000 style splice cassettes, modules or panels, providing up to 72 duplex LC ports | Fiber Optic Enclosures |
| 760231464 | SD-4U | Standard Density 4U sliding Panel, accepts  (12) LGX/1000 style splice cassettes, modules or panels, providing up to 144 duplex LC ports | Fiber Optic Enclosures |
| **Adapter Panels** | | | |
| 760148171 | PNL-BK-024- MFA-LC02-AQ- NS | Adapter Pack, Black, 1000-Type, with 12 LazrSPEED® MM duplex LC adapters, aqua, no shutter | Fiber Optic Adapter Panels |
| 760149344 | PNL-BK-012- MFA-LC02-AQ- NS | Adapter Pack, Black, 1000-Type, with 6 LazrSPEED® MM duplex LC adapters, aqua, no shutter | Fiber Optic Adapter Panels |
| 760148361 | PNL-BK-024- SFA-LC02-BL- NS | Adapter Pack, Black, 1000-Type, with 12 TeraSPEED® SM duplex LC adapters, blue, no shutter | Fiber Optic Adapter Panels |
| 760149351 | PNL-BK-012- SFA-LC02-BL- NS | Adapter Pack, Black, 1000-Type, with 6 TeraSPEED® SM duplex LC adapters, blue, no shutter | Fiber Optic Adapter Panels |
| **Connectors** | |  |  |
|  | FUSE-LC9M62- 6 | AFL Global Fusion spliced 62.5μm OM1 connector, for 900μm fibers, six pack - Beige | Fiber Optic Connector (Legacy projects only) |
|  | FUSE-LC9SMU- 6 | AFL Global Fusion spliced OS2 connector, for 900μm fibers, six pack- Blue | Fiber Optic Connector (all new projects) |
|  | FUSE- LC9M50L-6 | AFL Global Fusion spliced 50μm OM4 connector, for 900μm fibers, six pack - Aqua | Fiber Optic Connector (Data Center Projects) |
| **J-Hooks** |  |  |  |
|  | CAT16HP | nVent CADDY 1 inch J-hook | Non-Continuous Cable Support |
|  | CAT32HP | nVENT CADDY 2 inch J-hook | Non-Continuous Cable Support |
|  | CAT48HP | nVENT CADDY 3 inch J-hook | Non-Continuous Cable Support |
|  | CAT64HP | nVENT CADDY 4 inch J-hook | Non-Continuous Cable Support |

END OF SECTION