Glendale Unified School District

Network Cabling
Global Specification

ETIS

January 8, 2018

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Director of IT

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I. GENERAL

A. Purpose

1. The purpose of this document is to provide a standard defining the structured communications cabling systems to be installed within Glendale Unified School District facilities. It is geared toward leveraging our legacy cabling infrastructure while upgrading to more recent technologies in new installations. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards and industry best practices.

2. Within this document, the facilities owner is Glendale Unified School District, and shall be referred to as such, or as “Glendale Unified School District”, or as “ETIS”. Bidding low-voltage installers shall be referred to as “Contractor”.

3. This specification defines quality standards and practices common to all Glendale Unified School District enterprise network cabling upgrades and Greenfield (new) projects.

4. In addition to this global cabling standard, individual projects will also have associated documentation such as Requests for Proposals (RFP), facility drawings, project schedules and requirements pertaining to that particular job. Such collateral will be referred to in this document as “Project-specific Documentation”, “Project Documentation”, or simply “Construction Documents”. Any conflict between this general specification and any project-specific documentation shall be brought to the attention of Glendale Unified School District and must be resolved in writing.

5. It is the responsibility of the installing contractor to evaluate these general recommendations and adapt them effectively to actual projects. Contractor is responsible for identifying and bringing to the attention of Glendale Unified School District any design directions that may be improved. All such changes shall be approved in writing from ETIS.

6. Note that while many portions of this global specification are addressed to "The Contractor", these requirements apply equally to anyone doing the network cabling and infrastructure work within Glendale Unified School District, whether those persons are outside contractors or persons directly employed by ETIS.

B. Scope of Work - Typical

1. Contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn over the completed system fully warranted and operational for acceptance by Glendale Unified School District

2. This specification includes structured cabling design considerations, product specifications and installation guidelines for low-voltage network systems and associated infrastructure including, but not limited to:

    a. Cabling Sub-system 1 – Horizontal Copper

    b. Cabling Sub-system 2 - Intrabuilding Fiber Backbone Cabling

c. Cabling Sub-system 3 – Interbuilding Fiber Backbone Cabling

d. Telecommunications Pathways

e. Communications Racks and Cable Managers

f. Communications Grounding Systems

g. Cabling Labeling and Administration

3. In addition to systems specifications, this document also addresses applicable codes and standards, contractor qualifications and requirements, system warranties and system testing and acceptance.

4. Products to be used in Glendale Unified School District telecommunications infrastructure projects are listed in “Appendix A” at the end of this document.

C. Applicable Regulatory References

1. Contractor is responsible for knowledge and application of current versions of all applicable standards and codes. In cases where listed standards and codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

2. ANSI/TIA:

a. ANSI/TIA-526-7-A (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

b. TIA-526.2-A (July 2015) Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable - Adoption of IEC 61280-1-1 ed. 2 Part 1-1: Test Procedures for General Communication Subsystems – Transmitter Output Optical Power Measurement for Single-Mode Optical Fibre Cable

c. ANSI/TIA-4994 (March 2015) Standard for Sustainable Information Communications Technology

d. ANSI/TIA-526-14-C (April 2015) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

e. ANSI/TIA-568.0-D (September 2015) Generic Telecommunications Cabling for Customer Premises (supersedes TIA-568-C.0 and TIA-568-C-1)

f. ANSI/TIA-568-C.2 (August 2009) Balance Twisted Pair Communications and Components Standards

g. TIA-568-C.2-1 (July 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 1: Specifications for 100 Next Generation Cabling

h. TIA-568-C.2-2 (November 2014) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 2: Additional Considerations for Category 6A Patch Cord Testing

i. TIA-568-C.3 (June 2008) Optical Fiber Cabling Components Standard (will be superseded by

ANSI/TIA-568.3-D after default ballot)

j. TIA-568-C.3-1 (October 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors (will be superseded by ANSI/TIA-568.3-D after default ballot)

k. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard

l. ANSI/TIA-568.1-D (September 2015) Commercial Building Telecommunications Infrastructure Standard (supersedes ANSI/TIA-C.1)

m. ANSI/TIA-569-D (April 2015) Telecommunications Pathways and Spaces

n. ANSI/TIA-598-D (July 2014) Optical Fiber Cable Color Coding

o. ANSI/TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard

p. ANSI/TIA-606-C (June 2017) Administration Standard for Telecommunications Infrastructure

q. ANSI/TIA-607-C (November 2015) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

r. ANSI/TIA-758-B (March 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard

s. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems

t. ANSI/TIA-942-B (July 2017) Telecommunications Infrastructure Standard for Data Centers (will be superseded by ANSI/TIA-942-B after balloting)

u. ANSI/TIA-1005-A (May 2012) Telecommunications Infrastructure Standard For Industrial Premises

v. ANSI/TIA-1005-A-1 (January 2015) Telecommunications Infrastructure Standard For Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A

w. ANSI/TIA-1183 (August 2012) Measurement Methods and Test Fixtures for Balum-Less Measurements of Balanced Components and Systems

x. ANSI/TIA-1183-1 (January 2016) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183

y. ANSI/TIA-1152 (September 2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

z. ANSI/TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard

aa. ANSI/TIA-4966 (May 2014) Telecommunications Infrastructure Standard for Educational Facilities

bb. TIA-455-104-B (February 2016) FOTP 104- Fiber Optic Cable Cyclic Flexing Test (supersedes TIA-455-104-A)

cc. TIA/EIA-455-25-D (February 2016) FOTP-25 Impact Testing of Optical Fiber Cables

dd. TIA-604-18 (November 2015) FOCIS 18 Fiber Optic Connector Intermateability Standard – Type MPO-16

ee. TIA-604-5-E (November 2015) FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO

ff. TIA-5017 (March 2016) Telecommunications Physical Network Security Standard

gg. TIA-TSB-155-A (Reaffirmed 10-6-2014) Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T

hh. TSB-184 (July 2009) Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling

ii. TSB-4979 (August 2013) Practical Considerations for Implementation of Multimode Launch Conditions in the Field

jj. TSB-190 (June 2011) Guidelines on Shared Pathways and Shared Sheaths

kk. TIA-TSB-162-A (November 2013) Telecommunications Cabling Guidelines for Wireless Access Points

ll. TSB-5018 (July 2016) Structured Cabling Infrastructure Guidelines to support Distributed Antenna Systems

mm. TIA-492AAAD (October 2009) Detail specification for 850-nm laser-optimized, 50-um core diameter/125-um cladding diameter class Ia graded-index multimode optical fibers

nn. TIA-455-243 (March 2010) FOTP-243 Polarization-mode Dispersion Measurement for Installed Single-mode Optical Fibers by Wavelength-scanning OTDR and States-of-Polarization Analysis

oo. TSB-172-A (February 2013) Higher Data Rate Multimode Fiber Transmission Techniques

3. ISO/IEC

a. ISO/IEC 11801 Edition 2.2: Information Technology – Generic Cabling For Customer Premises

b. ISO/IEC 24702 Edition 1.0: Information Technology – Generic Cabling – Industrial Premises

c. ISO/IEC 24764 Edition 1.0: Information Technology – Generic Cabling Systems For Data Centres

d. ISO/IEC 14763-2 Edition 1.0: Implementation and Operation of Customer Premises Cabling – Part 2: Planning and Installation

e. ISO/IEC 14763-3 Edition 1.1: Implementation and Operation of Customer Premises Cabling – Part 3: Testing of Optical Fibre Cabling

4. National Electric Codes

a. National Electrical Safety Code (NESC) (IEEE C2-2012)

b. ANSI/NFPA 70-2011, National Electrical Code© (NEC©)

c. ANSI/IEEE C2-207, National Electrical Safety Code®

d. National Electrical Code (NEC) (NFPA 70)

5. OSHA Standards and Regulations – all applicable

6. Local Codes and Standards – all applicable

7. BICSI – Building Industry Consultative Services International

   a. Telecommunications Distribution Methods Manual, 13th Edition

   b. ANSI/BICSI 005-2013, Electronic Safety and Security (ESS) System Design and Implementation Best Practices

   c. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition

   d. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices

   e. Network Systems and Commissioning (NSC) reference, 1st Edition

   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling

   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

   h. AV Design Reference Manual, 1st Edition

   i. Network Design Reference Manual, 7th Edition

   j. Outside Plant Design Reference Manual, 5th Edition

   k. Wireless Design Reference Manual, 3rd Edition

   l. Electronic Safety and Security Design Reference Manual, 3rd Edition

   m. Commercial Installation On-the-Job Training Booklet

   a. Telecommunications Project Management (TPM) reference, 1st Edition

8. Anywhere cabling standards conflict 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.

9. Knowledge and execution of applicable standards and codes is the sole responsibility of the Contractor.

10. Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense.

D. Substitution Policy

1. This is a performance-based specification based on the experience of Glendale Unified School District in providing exceptional solutions for all of our facilities and departments. As such,

substitution of specified systems is discouraged, but allowed if Contractor strictly follows the Glendale Unified School District Substitution Policy outlined below.

2. Contractors offering product substitutions or equivalents are responsible for proving equal or superior mechanical and transmission performance to those products listed herein.

3. The process for substituting products other than those specified is as follows:

   a. Any Contractor wishing to offer structured cabling or associated infrastructure products other than those specified shall submit a request for product substitution in writing no less than one week in advance of bid.

   b. Written requests for substitution shall be accompanied by three samples of the substitution product along with associated drawings, specification sheets and engineering documents for evaluation by Glendale Unified School District.

   c. Any copper or fiber cabling products that carry signal shall be accompanied by third party laboratory performance test reports from an ITS/ETL, proving equivalency in transmission performance.

   d. Performance tests from the manufacturer of the product will not be accepted. Tests other than channel link will not be accepted.

   e. Equal product acceptance must be received from Glendale Unified School District in writing to be valid.

   f. Contractor shall assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

E. Contractor Qualifications

1. General

   a. Contactor shall be a current Panduit ONE℠ Partner, Silver level or above only, that has completed the Structured Cabling Deployment Training (Panduit Certified Installer). A copy of the corporate Panduit manufacturer certification shall be included with all quotes.

   b. Contractor must have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.

   c. Contractor shall have offices and service personnel based within a sixty-five mile radius of Glendale Unified School District and be capable of same-day response to service calls.

   d. Contractor shall have the responsibility to obtain any of the necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.

   e. At least 30 percent of the technicians on the job must have a current Panduit Certified Copper Technicians certificate, or accepted substitute manufacturer, to install copper distribution systems.

f. At least 30 percent of the technicians installing any Fiber Distribution Systems must have a current Panduit Certified Fiber Technicians certificate, or accepted substitute manufacturer certificate, to install fiber distribution systems

g. The Telecommunications contractor must provide a project manager to serve as the single point of contact to manage the installation, speak for the contractor and provide the following functions:

- Initiate and coordinate tasks with the Glendale Unified School District Project Manager and others as specified by the project schedule.
- Provide day to day direction and-site supervision of Contractor personnel.
- Ensure conformance with all contract and warranty provisions.
- Participate in weekly site project meetings.
- This individual will remain project manager for the duration of the project. The contractor may change Project Manager only with the written approval of Glendale Unified School District.

h. Contractor Project manager must be manufacturer certified in the copper and fiber information transport systems to be installed.

2. References

a. Communications Contractor shall provide with bid, a list of three reference accounts where similar Data, Voice, Fiber Optic Cable, and related equipment installation work was performed within the last year (twelve-month period).

3. Termination of Services

a. Glendale Unified School District reserves the right to terminate the Communication Contractor's services if at any time the Glendale Unified School District Engineer determines the Communication Contractor is not fulfilling their responsibilities as defined within this document.

b. Contractor's appearance and work ethics shall be of a professional manner, dress shall be commensurate with work being performed.

c. Dress displaying lewd or controversial innuendos will strictly be prohibited.

d. Conduct on Glendale Unified School District property will be professional in nature.

e. Any person in the Contractor's employ working on a Glendale Unified School District project considered by Glendale Unified School District to be incompetent or disorderly, or for any other reason unsatisfactory or undesirable to ETIS, such person shall be removed from work on the Glendale Unified School District project.

f. Upon termination, the Communications Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.

4. Other Contractor Responsibilities

a. Confirmation of Pathway and Cable Manager Sizing:

- Wherever cabling pathways or managers are installed, it is the Contractor's responsibility to confirm pathway or manager sizing to represent no more than 30% fill according to manufacturer's fill charts based on projected cable densities when racking systems and cabling pathways are fully populated.
- Pathways overfilled upon installation will not be accepted and shall be remedied at Contractor expense.

b. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job. All work areas will be cleaned at the conclusion of the workday and no tools or materials shall be left in a manner as to pose a safety hazard.

c. Contractor must remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. Removal of orphaned cable is mandatory. Contractors must consider this when placing bids.

d. Contractor shall abide by the regulations set by local Glendale Unified School District's Security Policy pertaining to access and conduct while on Glendale Unified School District property.

e. Contractor shall all obey all posted speed limits and parking regulations at the Glendale Unified School District facilities where the work is being performed.

F. Warranty

1. General

a. Contractor shall provide a 25 year Panduit Certification PLUS™ System Warranty (or Glendale Unified School District approved equal) on all copper and fiber permanent cabling links.

b. It is understood the Certification PLUS™ Warranty is a system performance warranty guaranteeing for 25 years from acceptance that the installed system shall support all data link protocols for which that Category of copper cabling system or fiber OM/OS designation of fiber optic system is engineered to support according to current and future IEEE and TIA standards.

c. The Certification PLUS™ System Warranty may be invoked only if the cabling channel links are comprised of continuous Panduit/General Cable components, including patch cords, equipment cords and fiber jumpers.

d. Upon acceptance of Warranty, Panduit will mail a notification letter to the installer and a notification letter and warranty certificate to Glendale Unified School District.

2. Contractor Warranty Obligations

a. Installation firm (Contractor) must be a current Panduit ONE Partner or approved equivalent manufacturer in good standing and shall include a copy of the company installation certification with the bid.

b. Contractor shall name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in Panduit Technician Certification Training, or approved equal, and according to all Standards cited in the Regulatory References section of this document.

c. Contractor liaison (project supervisor) shall have a current, up-to-date Panduit Certified Technician (PCT) certificate in both copper and fiber. Copies of the copper and fiber certificates of the Panduit liaison shall be submitted with the bid. These requirements are the same for accepted equivalent manufacturers. See “Substitution Policy” for mandatory procedure when offering substitutions.

d. Fiber optic cabling system additions and upgrade to existing facilities (Brownfield) shall match the fiber type (OM/OS designation) of the system to which it is being installed. Contractor shall under no circumstances mix different OM/OS classes of cable or termination devices (connectors) within the same system.

e. All intrabuilding new fiber optic installations shall utilize an appropriate construction of OM3/OM4 or OS1/OS2 fiber as specified herein.

f. All UTP cable pulled and terminated shall be Category 6A cable and connectivity whether new or legacy systems.

g. All UTP terminations within the Glendale Unified School District Greenfield (new) projects shall be terminated using the T568B pin-out (wire map). Legacy additions shall match the copper pin-out of the facility to which cabling is being added-to or upgraded.

h. Contractor shall install all racking and support structures according to cited Standards in such fashion as to maintain both cited industry standards as well as manufacturer recommendations for uniform support, protection, and segregation of different cable types,

i. Contractor is responsible for maintenance of maximum pulling tensions, minimum bend radius, and approved termination methods as well as adhering to industry accepted practices of good workmanship.

j. Contractor is responsible for understanding and submitting to Panduit all documents required prior to project start to apply for the Panduit Certification PLUS warranty. These include but are not limited to the project information form and SCS warranty agreement. These requirements are the same for accepted equivalent manufacturers. See “Substitution Policy” for mandatory procedure when offering substitutions.

k. Contractor is responsible for understanding and submitting to Panduit all documents required at project end. These include, but are not limited to: completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested. These requirements are the same for accepted equivalent manufacturers. See “Substitution Policy” for mandatory procedure when offering substitutions.

l. Test results shall be delivered in the tester native format (not Excel) and represent the full test report, summaries shall not be accepted. Contact your Panduit representative for a current list of approved testers, test leads and latest operating systems.

m. The Communications Contractor will correct any problems and malfunctions that are warranty-related issues without additional charge to Glendale Unified School District for the entire warranty period.

n. The warranty period shall commence following the final acceptance of the project by Glendale Unified School District and written confirmation of Warranty from Panduit. These requirements are the same for accepted equivalent manufacturers. See “Substitution Policy” for mandatory procedure when offering substitutions.

<END OF SECTION>

II. Installation and Maintenance Guidelines

A. Maintenance of Patch Fields

1. Any persons, whether with a Contractor or Glendale Unified School District, adding or moving copper or fiber optic patch (equipment) cords shall do so in a neat, workmanlike fashion in keeping with the original system cable management design concept and according to all industry best practices as outlined in cabling standards and applicable BICSI publications referenced in this document.

2. Persons performing such moves, adds or changes (MACs) shall further adhere to the following:

    a. Use existing cabling management pathways and take care to place cable like with like, maintaining original segregation strategies for separating fiber and copper cables as well as any separation necessary between different types of copper cables.

    b. Cables shall be dressed neatly within patch management pathways with care taken to maintain minimum bend radius of not less than 1 times the cord outer diameter for copper and not less than a 1" bend radius for fiber jumpers as per ANSI/TIA 568-C.0.

    c. All patch cords used shall be of same Copper Category or Fiber OM/OS designation as the media used in the permanent cabling links.

    d. Patching in all cases shall be done using factory terminated cords manufactured for that purpose. Hand terminated patch cords will not be accepted.

    e. All patch cords or jumpers must be completely contained within supplied cable management paths. Cables draped across the front cabinets or racks will not be accepted and shall be remedied at Contractor's expense.

    f. Any persons installing or moving fiber optic patch cords for any reason will clean the connector with lint-free wipes and 99% or higher isopropyl alcohol before replacing the connector in a patch or equipment port.

    g. Any technicians, whether with Glendale Unified School District or Contractors performing moves, adds or changes within patch field will label additions to the system according to the labeling conventions in place at that facility.

    h. Any persons with Glendale Unified School District or installing Contractor performing moves, adds or changes within patch field will record the move according to record system in place at that facility.

B. Cable Pulling and Termination

1. General

    a. Contractor is responsible for installing systems according to all applicable codes and the standards cited in this document.

    b. Contractor shall use grommets to protect the cable when passing through metal studs or any openings

that can possibly cause damage to the cable. This includes grommets on ends of hard conduit where used.

c. Do not deform the jacket of the cable. The jacket shall be continuous, free from pinholes, splits, blisters, burn holes or other imperfections.

d. Install proper cable supports, spaced less than 5 feet apart, and within manufacturer's requirements for fill ratio and load ratings.

e. Leave a pull string to the end of each conduit run. Replace pull string if it was used for a cable pull.

f. Note service loops may not touch the drop-ceiling assembly. Any portion of the communications cabling making contact with ceiling structures must be remedied at the Contractor expense.

g. Label every cable within 12 in. of the ends with self-laminating wire wrap cable appropriate to that cable size. Use a unique number for each cable segment as required by the project documentation and the labeling section of this document.

h. Dress the cables neatly with hook and loop cable ties in telecommunications rooms. Plastic ties are approved in pathways where cable bundles will not be reentered. Contractor responsible for using plenum ties and appliances in air-return (plenum) spaces as required by the local AHJ (Authority Having Jurisdiction).

i. Contractors installing cabling systems in Glendale Unified School District facilities shall install plenum rated cable in all instances. Non-plenum cable is not allowed and shall be removed at Contractor's expense.

1. Copper

a. When making additions to legacy systems, Contractor shall match the cabling configuration (pinout) of the existing systems. Legacy systems at Glendale Unified School District are in most cases T568B.

b. Within all new (Greenfield) installations within Glendale Unified School District facilities, contactor shall use copper pinout T568B.

c. All four pair Category 6A cable runs shall be kept to a maximum permanent link length of 83 meters when using a total 10 meters of 28 awg "small diameter" patch cords.

d. Copper links that are 90 meters in permanent link, shall not exceed 6 meters (total) of patch cords when using 28 awg "small diameter" patch cords.

e. Use low to moderate force when pulling cable. Maximum tensile load may not exceed 25' lbs. maximum pulling force per 4 pair cable.

f. No pathway, including conduits shall have greater than a 35% fill per manufacturer fill charts. Contractor is responsible for bringing to the attention of Glendale Unified School District project manager any insufficiently sized conduit or cable pathways in project documentation.

g. Keep Category 6A cables as far away from potential sources of EMI (electrical cables, transformers, light fixtures, etc.) as required in cited TIA Standards.

h. All copper horizontal cabling shall have slack service loops no less than 12" at the work area (equipment outlet) and not less than 3 feet in the telecommunications room.

i. Slack at the work area may be stored in the ceiling or in the wall space. Service loops in the telecommunications room may be wall mounted or contained in pathways or racking systems if done in a neat, workmanlike fashion.

j. Service loops shall be stored in such fashion as to not violate bend radius, slack touching the drop ceiling is not allowed and must be remedied at Contractor expense.

k. Maintain the twists of the pairs all the way to the point of termination, or no more than 0.5" (one half inch) untwisted.

l. All UTP patching shall be accomplished using Category 6A rated modular patch panels as indicated elsewhere in this document.

m. All removed copper cable is to be disposed of in a Glendale Unified School District recycling bin designated for “copper”, or removed from the property to be disposed of by Contractor if this is the instructions in the project documentation.

2. Fiber

a. When making additions to legacy systems, Contractor shall match the fiber type and fiber connectors used within that system.

b. Within all new (Greenfield) fiber installations within Glendale Unified School District, contactor shall use Panduit OptiCam LC connectors as specified in the fiber section of this document.

c. When installing fiber cable, Contractor shall maintain a minimum bend radius, both under pulling load and static (installed), per requirements outlined within TIA standards, or manufacturer’s recommendations, whichever is the most stringent.

d. Fiber terminations shall be done according to recommendations of TIA, manufacturer’s requirements and accepted industry best practices.

e. All unjacketed fiber shall be contained within appropriate fiber enclosures. Exposed tight-buffered or loose-tube strands will not be tolerated and shall be remedied at Contractor’s expense.

f. Contractor shall use fusion splices when terminating loose-tube fiber in legacy installations. New installations shall use indoor/outdoor tight-buffered fiber constructions.

g. Contractor shall perform test setup and testing according to guidelines in the “Testing and Acceptance” section of this document.

<END OF SECTION>

III. Cabling Systems and Associated Infrastructure

A. Cabling Subsystem I – Horizontal Cabling System

1. Slack (Service Loops) in Horizontal UTP Cable

    a. Horizontal cable in Glendale Unified School District facilities is routed through conduit, but electrical boxes are not used for low-voltage communications cable.

    b. Contractor shall use low-voltage mounting brackets (“box-eliminators”) for mounting low-voltage communications faceplates.

    c. Contractor shall provide a minimum 12” slack or service loop at the equipment outlet (work area) on each terminated copper horizontal permanent link. Work area slack shall be contained within the wall behind the faceplate if this may be done easily without violating cable bend radius.

    a. Where there is not sufficient space behind the faceplate, Contractor may pull work area slack into the ceiling space and properly store service loop with appropriately rated hook and loop cable ties. Cable slack shall in no instances touch the ceiling grid or associated drop ceiling components or fixtures.

    b. Contractor shall provide a minimum of 10 feet slack or service loop in the horizontal telecommunications room on each terminated copper horizontal permanent link, to be stored on the wall backboard using appropriate mounting fixtures built to that purpose (i.e. D-rings).

    c. Contractor should consult project-specific documentation or the Glendale Unified School District project liaison for other mounting methods where wall mount is not an option.

2. Metal Conduit

    a. Cable in horizontal runs in classrooms shall be routed and contained in metal conduit.

    b. Contractor shall size conduit large enough to accommodate at least 50% growth, i.e. conduit for 4 cables shall be sized to accommodate 6 cables, etc.

3. Equipment Outlets (Faceplates)

    a. When adding horizontal cabling to existing facilities (Brownfield) within Glendale Unified School District, Contractor shall match the existing cable plant regarding color of existing raceway and faceplates.

    b. Flush mount faceplates in new projects (Greenfield) shall be Mini-Com® Classic Series Faceplates with Label and Label Cover or Glendale Unified School District approved equivalent.

    c. Faceplates shall be form-molded plastic, single-gang, International White (eggshell) in color and available in 2, 3, 4 and 6 hole versions. Faceplates shall further have the following characteristics:

        - Accept Mini-Com ® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
        - Include label/label covers for easy port identification.
        - Have available replacement label/label covers.

d. Contractor shall use blank inserts to reserve space on any unused positions (holes) in faceplates.

e. See appendix A for part numbers.

4. Equipment Outlets – Surface Boxes

a. Wireless Access Points (WAPs) mounted on walls and ceilings utilize (2) Category 6A horizontal runs (drops) terminated in a 2 port white Mini-Com® Surface Mount.

b. Two hole boxes shall further meet the following requirements:

- Accept Mini-Com ® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
- Mount easily with supplied mounting screws, adhesive tape, or optional magnet (CBM-X).
- Cable entry from side and rear knockouts and from opening in center of base.
- CBXJ2 and CBX2 include built-in removable blank to add a second module.
- Optional adhesive labels available.

5. Copper Jacks – All Work Areas Category 6A

a. Copper jacks shall be Mini-Com® TX6A™ PLUS UTP Jack Modules or Glendale Unified School District approved equivalent.

b. Category 6A jacks at the work area shall be color blue or Glendale Unified School District approved color.

c. Jacks used to populate angled modular panels shall be black or Glendale Unified School District approved color.

d. Category 6A jacks shall further meet the following requirements:

- Exceed ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA standards
- Meet requirements of IEEE 802.3af and IEEE 802.3at for PoE applications
- Be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
- Color-coded, keyed jack modules mechanically and visually distinguish connections to prevent unintentional mating with unlike keyed or non-keyed modular plugs accommodating more discrete networks.
- Include MaTriX split foil tape to suppress the effects of alien crosstalk, allowing 10 Gb/s transmission even in high density 48-port, 1RU patch panels.
- Utilize patent-pending enhanced Giga-TX ™Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist.
- Rated for 2500 cycles with IEEE 802.3af / 802.3at and proposed 802.3bt type 3 and type 4
- Meets ANSI/TIA-1096-A contacts plated with 50 microinches of gold for superior performance.

- Require no punch down tool required; termination tool (EGJT) ensures conductors are fully terminated by utilizing a smooth forward motion without impact on critical internal components for maximum reliability.
- Have available a high-volume “gun-style” optional termination tool (TGJT) that reduces termination time by 25% and is ideal for high volume installations.
- Have guaranteed ability to be re-terminated a minimum of twenty times without measurable degradation of performance.
- Employ a blue termination cap to designate Category 6A performance at a glance and provides positive strain relief; help control cable bend radius and securely retain terminated cable.
- Have range to terminate 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable.
- Utilize a universal termination cap is color-coded for T568A and T568B wiring schemes for flexibility across installations.
- Accept 6 and 8-position modular plugs without damage to conductor pins.
- Identified options that include optional labels and icons.
- Be compatible with Mini-Com ® Modular Patch Panels, Faceplates, and Surface Mount Boxes.
- Have available optional RJ45 blockout device that blocks out unauthorized access to jack modules and potentially harmful foreign objects, saving time and money associated with data security breaches, network downtime, repair, and hardware replacement
- Have an optional dust cap keeps out dust and debris while not in use.

e. See Appendix A at the end of this document for part numbers.

6. Copper Jacks - Wireless Access Points (WAPs) Category 6A (Option Input Field terminable RJ45 plug, FP6X88MTG, to eliminate jack and biscuit)

a. Copper jacks shall be Mini-Com® TX6A™ PLUS UTP Jack Modules or Glendale Unified School District approved equivalent.

b. Category 6A jacks at the WAP area shall be blue or Glendale Unified School District approved color.

c. Jacks used to populate angled modular panels shall be black.

d. Category 6A jacks shall further meet the following requirements:

- Exceed ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA standards
- Meet requirements of IEEE 802.3af and IEEE 802.3at for PoE applications
- Be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
- Color-coded, keyed jack modules mechanically and visually distinguish connections to prevent unintentional mating with unlike keyed or non-keyed modular plugs accommodating more discrete networks.

- Include MaTriX split foil tape to suppress the effects of alien crosstalk, allowing 10 Gb/s transmission even in high density 48-port, 1RU patch panels.
- Utilize patent-pending enhanced Giga-TX ™Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist.
- Rated for 2500 cycles with IEEE 802.3af / 802.3at and proposed 802.3bt type 3 and type 4
- Meets ANSI/TIA-1096-A contacts plated with 50 microinches of gold for superior performance.
- Require no punch down tool required; termination tool (EGJT) ensures conductors are fully terminated by utilizing a smooth forward motion without impact on critical internal components for maximum reliability.
- Have available a high-volume “gun-style” optional termination tool (TGJT) that reduces termination time by 25% and is ideal for high volume installations.
- Have guaranteed ability to be re-terminated a minimum of twenty times without measurable degradation of performance.
- Employ a blue termination cap to designate Category 6A performance at a glance and provides positive strain relief; help control cable bend radius and securely retain terminated cable.
- Have range to terminate 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable.
- Utilize a universal termination cap is color-coded for T568A and T568B wiring schemes for flexibility across installations.
- Accept 6 and 8-position modular plugs without damage to conductor pins.
- Identified options that include optional labels and icons.
- Be compatible with Mini-Com ® Modular Patch Panels, Faceplates, and Surface Mount Boxes.
- Have available optional RJ45 blockout device that blocks out unauthorized access to jack modules and potentially harmful foreign objects, saving time and money associated with data security breaches, network downtime, repair, and hardware replacement
- Have an optional dust cap keeps out dust and debris while not in use.

e. See Appendix A at the end of this document for part numbers.

7. Category 6A Unshielded Twisted Pair Cable – All Work Areas

   a. Inside 4 pair horizontal cable for Glendale Unified School District facilities shall be blue jacketed plenum rated General Cable GenSPEED® 10 Category 6A UTP Copper Cable or Glendale Unified School District approved equivalent.

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

      - Exceeds requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA channel standards.
      - Guaranteed +2 dB over TIA 568-C.2 Standard for both PSANEXT & PSAACRF.

- Meets requirements of IEEE 802.3af and IEEE 802.3at for PoE applications.
- Third party tested to comply with ANSI/TIA-568-C.2.
- Cable diameter: Plenum 0.250 in.
- Installation temperature range: 32°F to 140°F (0°C to 60°C).
- Operating temperature range: -4°F to 194°F (-20°C to 90°C).
- Include innovative cross-web separator with patented design to provide superior internal electrical characteristics by locking the pairs into a systematic orientation within the cable while minimizing cable diameter.
- Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable scrap.

c. See Appendix A at the end of this document for cable part numbers.

8. Wireless Access Points (WAPs) Category 6A Unshielded Twisted Pair Cable

a. Inside 4 pair horizontal cable for Glendale Unified School District facilities shall be blue jacketed plenum rated General Cable GenSPEED® 10 Category 6A UTP Copper Cable or Glendale Unified School District approved equivalent.

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

- Exceeds requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA channel standards.
- Guaranteed +2 dB over TIA 568-C.2 Standard for both PSANEXT & PSAACRF.
- Meets requirements of IEEE 802.3af and IEEE 802.3at for PoE applications.
- Third party tested to comply with ANSI/TIA-568-C.2.
- Cable diameter: Plenum 0.250 in.
- Installation temperature range: 32°F to 140°F (0°C to 60°C).
- Operating temperature range: -4°F to 194°F (-20°C to 90°C).
- Include innovative cross-web separator with patented design to provide superior internal electrical characteristics by locking the pairs into a systematic orientation within the cable while minimizing cable diameter.
- Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable scrap.

c. See Appendix A at the end of this document for cable part numbers.

9. Distributor I (Horizontal Patch Panels) – Angled standard density patch panels

a. Glendale Unified School District copper patch panels in the horizontal patch fields shall angled 1 RU or

2 RU Mini-Com® Modular Faceplate Patch Panels, or approved equivalent, as needed to accommodate UTP cable quantity.

b. Modular patch panels shall be standard density of 24 ports per rack unit with front removable retaining plates so installing work may be done from the front of the rack in tight spaces.

c. Contractor shall populate modular panels with black Panduit Category 6A jacks, or approved equivalent as described elsewhere in this document. See Appendix A for part numbers on jacks to go with modular patch panels.

d. Patch Panels shall further meet the following criteria:

- Have release snap feature on faceplate to allow front access to installed modules.
- Accept Mini-Com® Modules for UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
- Be available in label versions available for easy port identification, with replacement label/label covers available.
- Mount to standard EIA 19" racks or 23" racks with optional extender brackets.
- Be available in angled patch panels to facilitate proper bend radius control and minimize the need for horizontal cable managers.

e. For detailed part numbers see “Appendix A” at the end of this document.

10. Work Areas - Small Diameter Category 6A Copper Patch Cords

a. Copper patching of Category 6A links in Glendale Unified School District facilities shall use Panduit 28 awg “small diameter” patch cords.

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

c. Small diameter patch cords shall have the following characteristics:

- Cable diameter not more than 0.185 in. (4.7mm) nominal.
- Category 6A/Class EA channel and component performance.
- Exceeds all ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA electrical performance requirements for all frequencies from 1 to 500 MHz
- FCC and ANSI compliance: Meets ANSI/TIA/EIA-1096-A; contacts plated with 50 micro inches of gold for superior performance.
- IEC compliance: Meets IEC 60603-7
- PoE compliance: Meets IEEE 802.3af and IEEE 802.3at for PoE applications in bundle sizes up to 48 cables.
- Operating temperature: 14°F to 140°F (-10°C to 60°C).
- Storage temperature: -40°F to 158°F (-40°C to 70°C).

- Plug housing: UL94V-0 rated clear Polycarbonate.
- Contacts: Gold plated phosphor bronze.
- RoHS compliance: Compliant.
- Flammability rating: CM/LSZH dual rated.

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

g. See Appendix A for part numbers..

11. Wireless Access Points (WAPs) Small Diameter Category 6A Copper Patch Cords

a. Copper patching of Category 6A links in Glendale Unified School District facilities shall use Panduit 28 awg “small diameter” patch cords.

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

c. Small diameter patch cords shall have the following characteristics:

- Cable diameter not more than 0.185 in. (4.7mm) nominal.
- Category 6A/Class EA channel and component performance.
- Exceeds all ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA electrical performance requirements for all frequencies from 1 to 500 MHz
- FCC and ANSI compliance: Meets ANSI/TIA/EIA-1096-A; contacts plated with 50 micro inches of gold for superior performance.
- IEC compliance: Meets IEC 60603-7
- PoE compliance: Meets IEEE 802.3af and IEEE 802.3at for PoE applications in bundle sizes up to 48 cables.
- Operating temperature: 14°F to 140°F (-10°C to 60°C).
- Storage temperature: -40°F to 158°F (-40°C to 70°C).
- Plug housing: UL94V-0 rated clear Polycarbonate.
- Contacts: Gold plated phosphor bronze.
- RoHS compliance: Compliant.
- Flammability rating: CM/LSZH dual rated.

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

e. See Appendix A for part numbers.

12. Surface Mount Raceway – Wall Mount

a. On brownfield installations, Contractor shall match raceway to that already installed in the facility unless instructed otherwise in project-specific documentation.

b. On Greenfield installations where environment (cinder block walls) or project documentation requires cable to be surface-mounted in the work area; horizontal cable shall be routed through Panduit LD10 International White (color), plastic “latching-duct raceway or Glendale Unified School District approved equivalent.

c. Contractor is responsible to size raceway to accommodate not less than 40% fill upon installation, per manufacturer fill tables, providing room for at least 50% growth in additional cables: i.e. a work area requiring 4 cables, raceway shall be sized to hold 6, etc. LD10 will allow up to 8 CAT6 cables at a max OD of .240. If over this limit, replace LD10 with Panduit T45/T70 series surface raceway according to cable fill ratio.

d. Contractor is responsible that LD10 raceway installation includes all associated fittings, drop ceiling fittings, couplers and 1” control-bend-radius fittings.

e. Contractor shall not rely on the pressure sensitive adhesive foam to mount raceway, but rather use adhesive to hold raceway in place while screwing down the raceway to the structure beneath using anchors appropriate to the wall type at intervals not to exceed 2 ft. (24 inches).

f. Standard LD-10 Panduit raceway shall have the following features:

- For routing data and low voltage cabling.
- One-piece hinged design allows cables to be laid in.
- Factory applied adhesive backing speeds installation.
- FT4 rated.
- Terminates using surface mount outlet box solutions or Panduit Mini-Com surface mount boxes

g. Installations requiring raceway shall use the same faceplates used in flush-mount applications as specified in this document, mounted on Panduit “JB1” surface boxes, or Glendale Unified School District approved equivalent. Glendale Unified School District shall not rely on adhesive-backing to hold surface boxes in place, but must use appropriate wall anchors for firm, permanent installation.

h. T45/T70 Pan-Way® Fast-Snap™/Snap-On Technology - Pan-Way® Fast-Snap™ Surface Mount Boxes assemble without the use of screws or additional hardware and can accommodate both power and communication applications. Fast-Snap™ Boxes can accept any standard NEMA 70mm screw-on faceplate. Pan-Way® Snap-On Faceplates attach directly to Fast-Snap™ Boxes, any 70mm raceway, Cove, or Pan-Pole™ device without the use of screws or additional hardware

i. Standard T45/T70 Pan-Way® Surface Raceway shall have the following features:

- allows multiple inline access points for space optimization and aesthetic installation
- supports any NEMA standard screw-on faceplate with use of device bracket and can reduce to smaller profile raceway (T-45 or LD raceway)
- shall have a modular divider wall that allows channel configuration flexibility

j. See Appendix A at the end of this document for part numbers.

13. Modular Furniture Raceway

a. Office and administrative areas repurposing used modular furniture may require additional cable pathway space and shall utilize Pan-Way ® Office Furniture Raceway System, or a Glendale Unified School District approved equivalent.

b. Such modular furniture raceway shall provide cable paths along the top of modular furniture partitions dropping services (equipment outlets) at work surface level.

c. Modular furniture raceway must meet the following requirements:

- UL listed in accordance with UL-5C requirements for Class 2 Communication Cable Management Systems.
- Maintains bend radius control throughout the entire office furniture raceway system as required by TIA/EIA-568-B and 569-B.
- Faceplates are compliant with the labeling requirements of the TIA/EIA-606-A standard.
- Robust design and tamper resistant closure increases product stability and prevents damage to cabling during and after installation.
- Product supplied with adhesive backing for fast and easy installation.
- Creates a virtually invisible solution for routing data cables on panels from all common manufacturers with a top cap width between 1.88" and 2.30".
- Designed for use with Pan-Net ® Connectivity, also accepts all common manufacturers' connectivity with use of a NEMA standard 70mm faceplate or module frame.

d. Consult Appendix A for part numbers.

14. Communications Poles

a. Many Glendale Unified School District offices use data communications poles to deliver data cables from the ceiling into the modular furniture.

b. Communications poles shall be Pan-Way® Pan-Pole™ Aluminum Outlet Poles for Power and Communication (or Glendale Unified School District approved equivalent), and must have the following properties:

- Pan-Pole™ Communication Poles provide industry-leading solutions for cable routing in the open-office environment.
- These aluminum poles accept 70mm snap-on faceplates, as well as NEMA-standard screw-mount faceplates, and are provided with non-metallic 70mm (2.75") covers.
- Communications poles are available in both 11- and 13-foot lengths.
- The single-channel communication-only pole allows for field installation of telephone, data network, or other low-voltage cabling.

15. See Appendix A for part numbers for 11' and 13' communications poles.

B. Cabling Subsystems II and III - Intrabuilding and Interbuilding Backbone Fiber

1. Singlemode Fiber Trunks for Use Within and Between Buildings

    a. On additions to existing Glendale Unified School District fiber cable plant (brownfield projects), Contractor shall match existing fiber and connector types.

    b. In new (Greenfield) Glendale Unified School District projects, backbone fiber running within buildings or running outdoors between buildings shall be Panduit singlemode, indoor/outdoor, plenum-rated, armored cable, or Glendale Unified School District approved equivalent.

    c. The purpose for standardizing on a single cable construction for any environment is to reduce total part numbers needed, and eliminate the need for costly innerduct installation and transition splicing where fiber trunks enter buildings.

    d. Singlemode trunks running between buildings shall be of 24 or 48 strands as indicated by project documentation.

    e. Singlemode trunks running between telecom rooms within buildings shall be of 12 strands unless otherwise indicated in project documentation.

    f. Fiber cable shall further meet the following qualifications:

        - Panduit® Opti-Core® Indoor/Outdoor Armored Cable with tight buffered fibers are an integral part of the Panduit end-to-end fiber optic solution, designed to support today's data needs while meeting tomorrow's ever-advancing network requirements.
        - This cable provides water blocking technology, high density, and easy installation in transitional aerial and duct applications and entrance facilities, and the 900µm tight-buffered fibers provide easy connectorization.
        - The tight-buffered fibers surrounded by aramid yarn strength members combine usability indoors and out. Interlocking aluminum armor eliminates the need for inner duct or conduit to provide a smaller crush resistant pathway for improved design flexibility and lower installed cost.
        - Cables with greater than 24 fibers feature a sub-unit design that simplifies fiber identification, provides easy access and routing of the fibers. It also increases cable durability with a dielectric central strength member.
        - Opti-Core® Fiber Optic Indoor/Outdoor Riser (OFNR) and Plenum (OFNP) Rated Cable with tight buffered fibers are tested in accordance with Telcordia GR-20, Issue 2, GR-409 and with relevant EIA/TIA-455 series FOTPs for fiber optic cable.
        - All multimode and singlemode cable is available in 2, 4, 6, 8, 12, and 24-fiber counts as a "non-subunitized" design and in 36, 48, 72, and 96-fiber counts (144 for Riser) as a "sub-unitized" design.
        - All Opti-Core® fiber cable is RoHS compliant.

    g. Plenum armored cable shall meet the following physical properties:

physical properties-plenum

Fiber Count	Cable O.D. Inches (mm)	Installation Bend Radius Inches (cm)	Long-Term Bend Radius Inches (cm)	Cable Weight Lb./kft. (kg/km)
2	0.45 (11.4)	4.5 (11.5)	9.0 (22.9)	81 (120)
4	0.45 (11.4)	4.5 (11.5)	9.0 (22.9)	85 (127)
6	0.47 (11.9)	4.7 (12.0)	9.4 (23.9)	87 (130)
8	0.48 (12.1)	4.8 (12.2)	9.4 (23.9)	91 (135)
12	0.51 (13.0)	5.1 (13.0)	10.2 (25.9)	95 (142)
24	0.58 (14.7)	5.8 (14.8)	11.6 (29.5)	131 (195)
36	0.938 (23.8)	8.0 (20.4)	16.0 (40.7)	167 (248)
48	0.938 (23.8)	8.1 (20.6)	16.2 (41.2)	243 (363)
72	1.052 (26.7)	9.4 (23.9)	18.8 (47.8)	361 (537)
96	1.189 (30.2)	10.9 (27.7)	21.8 (55.4)	511 (760)

h. Contractor shall bond to ground armor from fiber backbones at both ends as indicated in the grounding section of this document; using armored cable grounding kits listed in the Appendix A grounding section.

i. See Appendix A for all fiber cable part numbers.

2. LC Fiber Connectors

a. All tight-buffered indoor fiber trunks shall be terminated using Panduit singlemode LC OptiCam® Fiber Optic Connectors or Glendale Unified School District approved equal.

b. LC cam connectors shall further have the following properties:

- Be a TIA/EIA-604 FOCIS-10 compatible connector that exceed exceeds TIA/EIA-568-B.3 requirements.
- Have connector backbone and boot colors that follow TIA/EIA-568-C.3 suggested color identification scheme.
- Have insertion loss: 0.3dB average (multimode and singlemode).
- Have return loss: >26dB (10Gig ™multimode), >20dB (multimode), >50dB (singlemode).
- Be a spring-loaded “Senior” rear pivot latch LC connector.
- Be a pre-polished cam style termination for in less than half the time of field polish connectors.
- Have patented re-termination capability provides yield rates approaching 100%.
- Feature a factory pre-polished fiber end face eliminates time-consuming field polishing to reduce

installation costs, labor, scrap and the number of tools required.

- Be cam activated, with fiber and buffer clamp mechanisms that provide superior fiber and buffer retention with less sensitivity to fiber tensile loading.
- Utilize the OptiCam® Termination Tool that simplifies tooling and termination, and virtually eliminates operator error by providing a visual indication of proper termination after the cam step has been completed.
- Have a range of cable retention boot assemblies that consistently provide higher than industry standard cable retention.
- Include a non-optical disconnect that maintains data transmission under tensile loads for jacketed cable.
- Have ability to accept 900µm tight-buffered fiber with included boot(s), and accept 1.6mm – 2.0mm and 3.0mm jacketed cable with available OptiCam ®Cable Retention Boot Assemblies (ten per package).

c. See Appendix A for part numbers on singlemode LC fiber connectors.

3. Fiber Enclosures

a. Fiber cable terminations shall be contained in 1 RU, or 2 RU Panduit FCE series rack mount fiber enclosures, or Glendale Unified School District approved equal.

b. Contractor shall select enclosure size as needed for the number of fibers projected to be in that telecommunication space when fully populated.

c. Contractor shall fill any unused enclosure space with a blank fiber adapter panel (FAP).

d. FCE enclosures shall further have the following properties:

- Be able to hold QuickNet ™ Fiber Optic Cassettes, Opticom ® Fiber Adapter Panels, or splice modules.
- Have a slide-out, tilt-down drawer to provide full front access to all fibers and cables.
- Employ integral bend radius control and cable management appliances for fiber optic patch cords.
- Have rear cable management for proper slacking/spooling of trunk cable break-outs and interconnect cables.
- Have multiple trunk cable entry locations and include fiber optic cable routing kit (grommets, cable ties, spools, strain relief bracket, and ID/caution labels) for different installation configurations.

4. Fiber Adapter Panels

a. FCE fiber enclosures shall be populated with fiber adapter panels containing 6 singlemode duplex fiber adapters.

b. Contractor is responsible to blank out any enclosure spaces where adapter panels are not used.

c. Adapter panels shall further have the following features:

- Loaded with TIA/EIA-604 FOCIS-10 compatible adapters.

- Exceed TIA/EIA-568-B.3 requirements.
- Adapter housing colors follow TIA/EIA-568-C.3 suggested color identification scheme.
- Snap quickly into the front of all Opticom ® components
- LC fiber adapter panels are Sr/Jr. to conserve enclosure space.
- Accept FOCIS-10 compatible senior LC connectors at either end and FOCIS-10 junior LC connectors at the inside end for behind the wall applications.
- Both ends accept FOCIS-10 compatible senior LC connectors.
- Junior end also accepts FOCIS-10 compatible junior (fixed ferrule/springless) LC connectors.
- Choice of phosphor bronze or zirconia ceramic split sleeves to fit specific network requirements; zirconia ceramic split sleeves are recommended for OM4/OM4 multimode and OS1/OS2 singlemode applications.
- Every adapter is laser marked with Q.C. number to assure 100% traceability.
- LC adapters are also available in QuickNet ™ Fiber Optic Cassettes.

d. Consult Appendix A for fiber adapter panels and blank adapter panels.

5. Fiber Patch Cords

a. Fiber patch fields within Glendale Unified School District facilities shall utilize riser rated singlemode “push/pull” fiber jumpers (fiber patch cords) that have the following properties:

- Push-Pull LC Duplex Fiber Optic Patch Cords shall feature the push-pull strain relief boot and duplex clip, to allow users easy accessibility in tight areas when deploying very high density LC patch fields.
- Jumpers shall be available in OM3, OM4 and single-mode and be available in in riser (OFNR), plenum (OFNP), and low smoke zero halogen (LSZH) rated jacket materials.

b. See “Appendix A” at the end of this document for part numbers.

C. Cable Pathways

1. Overhead Metallic Pathway

a. Cable delivery over racking systems in telecommunications rooms shall be done with Wyr-Grid® overhead cable tray routing system or Glendale Unified School District approved equal.

b. Any pathway offered must have the following properties:

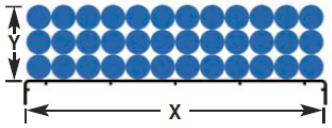
- Wyr-Grid® Pathways are provided in four widths: 12" (305mm), 18" (457mm), 24" (610mm), and 30" (762mm).
- Wyr-Grid® System incorporates non-integral snap-on sidewalls which minimize specification requirements and are offered in three different heights: 2" (50mm), 4" (102mm), and 6" (152mm).
- Wyr-Grid® Splice Connectors have an integral bonding screw that creates a mechanical-electrical bond between cable tray pathway sections.

- Wyr-Grid® Waterfalls are offered in two different configurations that attach to all pathway sections: 12" (305mm), 18" (457mm), 24" (610mm), and 30" (762mm) to facilitate bend radius control and cable management.
- Wyr-Grid® Support Brackets are offered in various widths to accommodate pathways: 12" (305mm), 18" (457mm), 24" (610mm), and 30" (762mm); have integral quick-clip retention; accommodate 1/2" or 12 mm threaded rods.

c. All metallic cable trays must be grounded and all sections bonded in accordance with listing requirements for the particular type of system and per TIA 607-B including most recent revisions, TSB and addenda.

d. Contractor is responsible sizing all pathways to represent no more than a 35% fill upon installation per manufacturer's fill chart below:

Wire Fill for Wyr-Grid® Overhead Cable Tray Routing System



X (in.)	Y (in.)	Internal Area (in^2)	Category 6A (SD) Diameter 6.1mm 0.240"	Category 6A Diameter 7.6mm 0.300"	Category 6 Diameter 6.1mm 0.240"	X (in.)	Y (in.)	Internal Area (in^2)	Category 6A (SD) Diameter 6.1mm 0.240"	Category 6A Diameter 7.6mm 0.300"	Category 6 Diameter 6.1mm 0.240"
12.2	2	24.3	269	172	269	24.2	2	48.3	534	342	534
	4	48.7	538	344	538		4	96.7	1069	684	1069
	6	73.0	807	516	807		6	145.0	1603	1026	1603
18.2	2	36.3	401	257	401	30.2	2	60.3	666	427	666
	4	72.7	804	514	804		4	120.7	1334	854	1334
	6	109.0	1205	771	1205		6	181.0	2000	1280	2000

"Y" equates to the height of the Wyr-Grid® Optional Sidewalls. The internal area defines the allowable fill capacity based on the Wyr-Grid® Pathway width and optional sidewall height. The Wyr-Grid® Pathway cable fill is based on NEC allowable fill of 50%.
The above cable diameters represent the nominal Panduit cable diameter per performance level.

e. All cable trays and grounding conductors should be clearly marked in accordance with manufacturer's instructions, applicable codes, standards and regulations.

f. Contractor shall take care to segregate and protect armored fiber from copper cabling in metallic pathway.

g. Bundled copper and fiber backbones shall be dressed to maintain segregation of cable types throughout the pathway. Innerduct or separate fiber duct is not necessary due to armored construction on fiber backbone.

h. See Appendix A for part numbers.

2. J-Hooks

a. Bundles of 120 Category 6 cables or less may be required to be routed above ceilings using J-hooks. Check project documentation for clarification.

b. J-hook systems used by Glendale Unified School District shall be Panduit "J-Pro" series, or Glendale Unified School District approved equivalent.

c. Contractor installing J-hook systems shall space them no more than 5 feet apart as per TIA 569-C standard.

d. Contractor is responsible for proper sizing of J-hook systems based upon cable count and manufacturers recommendations for fill, with new J-hooks to have not more than 30% fill per manufacturer's fill charts based upon projected worst case future bundle size.

e. If J-hooks are deemed too small by above criteria, Contractor shall bring this to the attention of Glendale Unified School District for resolution in writing. J-hook pathways that will not have sufficient capacity should be replaced in the design with the proper sized basket tray for future cable additions and flexibility.

f. J-hook systems used by Glendale Unified School District shall have the following properties:

- Patented design provides complete horizontal and vertical 1" bend radius control that helps prevent degradation of cable performance.
- UL 2043 and CAN/ULC S102.2 listed and suitable for use in air handling spaces.
- Pre-riveted assemblies allow for attachment to walls, ceilings, beams, threaded rods, drop wires and underfloor supports to meet requirements of a variety of applications.
- Wide cable support base prevents pinch points that could cause damage to cables.
- Cable tie channel allows user to easily install 3/4" (19.1mm) Tak-Ty ® Cable Ties to retain cable bundle.
- Durable non-metallic J Hook materials provide the ability to manage and support a large number of cables.
- Material: Black Nylon 6.6 J Hook with metal attachments.

g. See Appendix A for part numbers.

D. 19" Racks, Rack-mount Cable Managers, and Wall Mount Cabinets

1. Two-post Communications Racks

a. 2-post racks will be Panduit black-powdered aluminum (or Glendale Unified School District approved equivalent) and have the following properties:

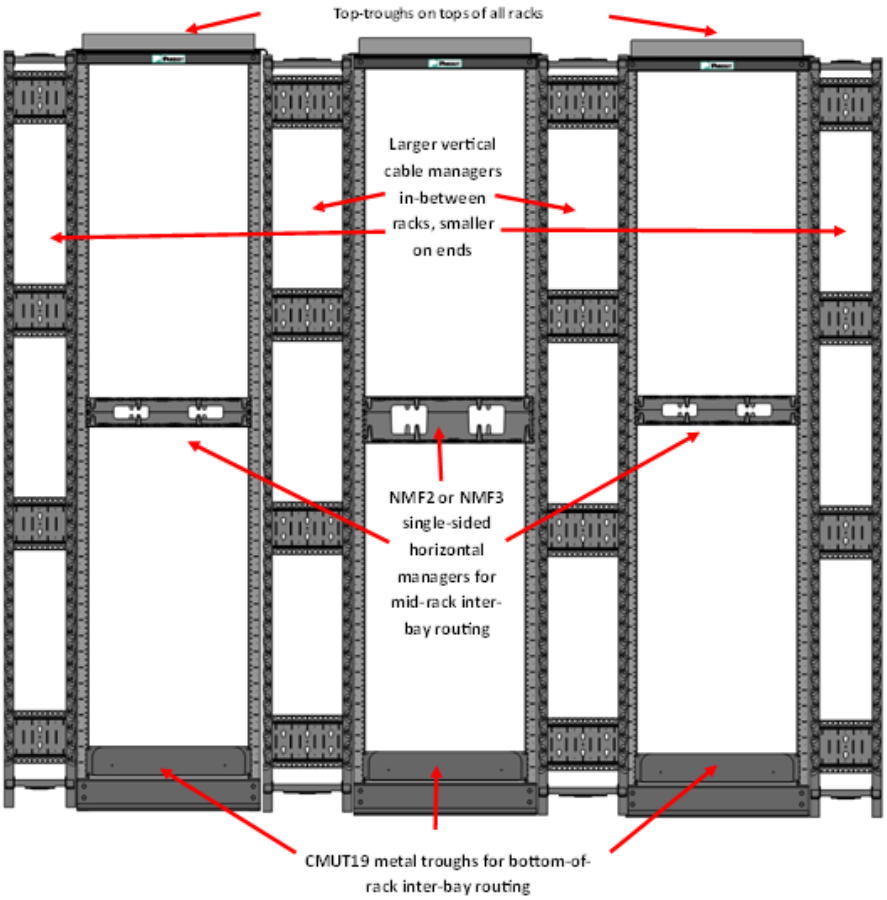
- 19" EIA rack, aluminum.
- Dimensions: 96.0"H x 20.3"W x 3.0"D (2134mm x 514mm x 76mm).
- Rack units numbering up from bottom to allow quick and easy location of rack mount items
- UL listed for 1,000 lbs. load rating.
- Double-sided #12-24 EIA universal mounting hole spacing with 24 #12-24 mounting screws included.
- Accepts all Panduit cable management and patch panel products in addition to any industry standard 19" components.
- Includes paint piercing washers for assembly to assure electrical continuity between components as pert TIA 607-B Bonding and Grounding Standard.

b. In telecommunications rooms with multi-bay rack rows configured such that patching will take place between racks, Contractor is responsible to include in design interbay routing pathways at the top, middle and bottom of each bay to provide efficient and neat routing between any two points within rack rows.

c. Interbay routing shall be provided in the form of top troughs, interbay mid-rack path and flanged shelf at the bottom. (See “Illustration of Interbay Routing” below).

Illustration of Inter-bay Routing in Rack Systems

(Note: Doors left off vertical and horizontal managers for clarity)



d. For bottom-of-rack interbay routing where cable quantities exceed capacity of CMUT19 troughs, Contractor shall substitute 4RU trough CMLT19.

e. All racks shall be outfitted with a vertical grounding busbar along one rail, with all equipment bonded to ground according to TIA 607-B Bonding and Grounding Standard. See Bonding and Grounding section of this document for details.

f. See Appendix A for part numbers.

2. Rack-mounted Cable Management – Vertical Managers

    a. Vertical cable managers shall be PatchRunner™ High Capacity Vertical Cable Management System in sizes 6” wide, 8” wide, 10” wide and 12” wide, or Glendale Unified School District approved equivalent.

    b. Contractor will use double sided (front and back) vertical managers on 2-post racks.

    c. All vertical cable managers shall have metal dual hinged doors.

    d. Contractor shall choose vertical cable manager width according to manufacturer’s fill tables to not represent more than a 35% fill at installation based on projected worst-case density when racks are fully populated.

    e. Vertical cable managers shall have the following features:

        - High density minimizes area required for network layout, freeing up valuable floor space.
        - Allows mounting of many standard EIA 19" accessories, such as patch panels, vertically in the manager.
        - Ventilated side walls provide maximum airflow for equipment cooling.
        - Snap on finger sections can be removed to improve airflow, and break away fingers allow routing of large cable bundles.
        - Large finger spacing accommodates up to 48 Cat6A cables.
        - Optional sure-close dual hinged metal doors provide easy access to vertical pathway and provide visual and audible feedback on closure.
        - Available in 7 foot version.

    f. In IDF rooms or areas where there are low cable counts, vertical cable managers shall be 4" wide NetRunner™ Vertical Cable Manager, dual sided.

    g. Part numbers are listed in Appendix A.

3. Rack-mounted Cable Management – Horizontal Managers

    a. Angle patch panels largely the need for horizontal cable managers, but there still may be instances requiring them. One example is in the network core where chassis switches are used.

    b. For these areas requiring horizontal cable managers, Contractor shall user double-sided NetManager ™ High Capacity Horizontal Cable Managers (or Glendale Unified School District approved equal) having the following features:

        - Innovative inset fingers slope inward toward back of managers offering unobstructed access to network cabling for easier moves, adds, and changes.
        - Large front finger openings easily accommodate Category 6A and 10 GbE cables, speeding installation and reducing maintenance costs.
        - Rear cable management finger spacing utilizes open D-rings for greater accessibility.
        - Can be used to create large capacity horizontal pathways for routing cable.

- Patented front and rear dual hinged cover allows cable access without removing cover.
- Curved surfaces maintain cable bend radius.
- Pass-through holes allow for front to rear cabling.
- Built in cable retainers hold cable in place for easy moves, adds, and changes.
- Mount to 19" EIA racks and cabinets.
- Covers, #12-24 and M6 mounting screws included.

c. See Appendix A for part numbers.

1. Wall Mount Cabinets

a. Shall be Hoffman Access-Plus (or Glendale Unified School District approved equivalent) and have the following properties

- Composite frame, injection molded top and bottom with extruded composite sides
- 140 degree opening – Front Door
- Field reversible left or right hinge – Front Door
- Quarter turnkey lock
- Window door is scratch resistant 1/4" tinted safety glass
- Welded 14 gauge steel with solid top center section, vented sides, self- latching, and a quick release center to rear section hinge with self-retaining pins – Center Section
- Rack Mounting Angles are to be 12 gauge plated steel with RU markings from top to bottom
- EIA universal spaced 19” mounting holes
- Tapped 10/32 holes
- Welded 14-gauge steel with radius corners – Rear Section
- Cable tie down points for cable management – Rear Section
- Cable entry and knockouts included : 1.1”, 2.5”, 3” – Rear Section
- Pretreated steel coated with RAL 9005 Black, light textured power paint finish

b. See Appendix A for part numbers.

E. Cable Accessories

1. Cable Ties

a. Cable bundles on racks and in pathways shall be bundled with re-enterable hook and loop cable ties

that come in continuous rolls.

b. Contractor is responsible for using plenum hook and loop ties in air-return spaces.

c. See “Appendix A” for part numbers.

2. Physical Security Devices

a. Some portions of Glendale Unified School District networks require additional physical security devices. These take three forms:

- Devices that block-out copper and fiber ports in patch fields and faceplates that require a special tool for removal.
- Devices that lock-in copper patch cords and require a special tool for removal of those patch cords.
- Devices that temporarily or permanently block USB ports on laptops and computers.

b. Areas where such devices are required will be called out in the project documentation.

c. See Appendix A for part numbers.

F. Communications Grounding Network

1. General

a. Contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA 607-C Standard.

2. Room Busbars

a. All Telecommunications spaces and distributor rooms shall have installed an appropriately sized wall-mount busbar with BICSI hole spacing that bonds to the building bonding backbone.

b. See Appendix A for appropriate room telecommunications grounding busbar.

3. Rack and Equipment Grounding

a. Contractor is responsible for properly grounding all network equipment, racks and cabinets and bonding them to the wall mounted busbars as described in the TIA 607-C standard.

b. All newly installed racks and cabinets shall have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.

c. Smaller equipment without an integrated grounding pad shall be bonded to the vertical busbar through the use of a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.

d. Larger equipment (chassis switches) with a designated grounding terminal shall be bonded to the vertical busbar with an EBC (equipment bonding conductor) kit built to that purpose.

e. Contractor shall take care to clean (wire brush, scotchbrite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.

f. All bonding lugs on racks and busbars shall be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and shall be removed and replaced at Contractor's expense.

g. Every rack or cabinet shall have an individual bonding conductor into the grounding network, serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.

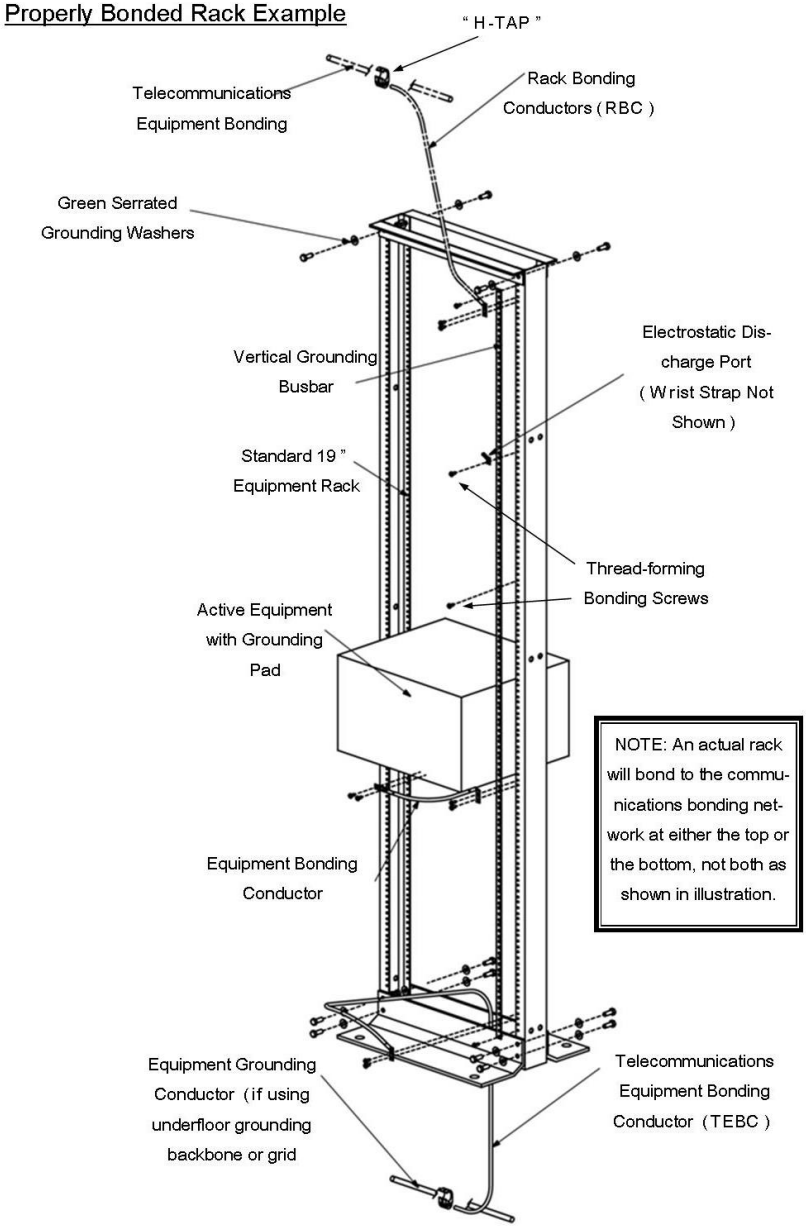
h. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less.

i. A minimum of every other rack or cabinet shall be outfitted with a properly installed and bonded ESD (electro-static discharge) port along with a wrist strap and lead to be used by any technicians servicing network equipment. On four post racks and cabinets these ESC ports and straps shall be provided on front and back to be accessible and able to reach any active equipment needing servicing.

j. Armored cables shall be properly bonded to the earthing system on both ends with a kit built to that purpose.

k. For examples of rack grounding refer to the illustrations below:

Properly Bonded Rack Example



<END OF SECTION>

IV. Network Labeling

A. General Requirements

1. When labeling any Glendale Unified School District network system, whether existing or new, Contractor shall always adhere to the following requirements:

    a. Contractor shall, wherever possible pre-print labels using Panduit Easy-Mark software and laser jet printer, or Glendale Unified School District approved equivalent.

    b. The Panduit PanTher (LS8E) hand-held thermal transfer printer or Glendale Unified School District approved equivalent shall be used on site to print labels that were unanticipated, or that become damaged in application.

    c. This labeling strategy shall, at a minimum, clearly identify all components of the system: racks, cables, panels and outlets, grounding, pathways and spaces like telecommunications rooms.

    d. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.

    e. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

    f. All label printing will be machine generated by either hand-held labeling systems or computer generated using programs and materials built specifically for communications labeling.

    g. Hand written labels will not be accepted and must be remedied at Contractors expense.

    h. Cabling system labels shall utilize materials designed to outlast the cabling elements to which they attach. Office quality labels will not be accepted.

    i. Cable labels shall be self-laminating, appropriately sized to the outside diameter of the cable and placed within view at the termination point on each end.

    j. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

    k. Machine-generated labels shall be installed behind the clear lens or cover on any device that provides such an option.

    l. All labels will be permanently affixed to installed cables, patch panels, racks, cabinets, and enclosures.

    m. Labels shall be legible and placed in a position that insures ease or visibility. Label type must be as listed in Appendix A - Materials section at the end of this document.

    n. Conduit shall be marked indicating the identification of the cable within.

    o. All cabling added to existing “legacy” installations shall follow the labeling convention in place at that location.

    p. All labeling of installed cabling in new (Greenfield) projects shall satisfy all requirements of TIA 606-B, or be modified as indicated in the project specific documentation.

<END OF SECTION>

V. Testing and Acceptance

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions.

2. All copper pairs or optical fibers of each installed cable shall be tested and verified prior to system acceptance.

3. Any defect in the cabling system performance or installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors or fibers in all cables installed.

4. All cables shall be tested in accordance with this document, the ANSI/TIA Standards, the PANDUIT® ™ System Warranty guidelines and best industry practice.

5. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Link Testing

1. All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA 1152 and ANSI/TIA 568-C.2 for the appropriate Category of cabling installed using a test unit meeting a minimum IEC IIIe level of accuracy.

2. All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is the more stringent.

3. Contractor shall set references according to manufacturer's recommendation prior to each day's testing and reset references anytime tester is left unused for more than two hours.

4. For warranty purposes, Contractor shall perform the appropriate Permanent Link test. Channel Link testing is rendered void by the movement of patch cords and can be run but not used for final acceptance criteria.

C. Fiber Testing

1. All installed fiber shall be tested for link-loss in accordance with ANSI/TIA-C.0 and shall be within limits specified within ANSI/TIA-C.3, or as spelled out in the project documentation.

2. For horizontal cabling system using multimode optical fiber, attenuation shall be measured in one direction at either 850 nanometer (nm) or 1300 nm using an LED light source and power meter.

3. Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

4. Backbone single-mode fiber cabling shall be tested at the 1310 and 1550 wavelengths in both directions.

5. Test set-up and performance shall be conducted in accordance with ANSI/568-C.0 standard, Method B.

6. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. Only basic link-loss testing with a power meter is required. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above.

7. The values for calculating loss shall be those defined in the ANSI/TIA 568-C.3 Standard. If the link loss requirements defined within the standard are in conflict with those referenced in the project documentation, Contractor shall immediately bring this to the attention of ETIS for resolution.

D. System Documentation

1. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to Glendale Unified School District for approval. Documentation shall include the items detailed in the sub-sections below.

2. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase.

3. Contractor shall submit with drawings a diagram of each telecommunications room with indicating which cabling drops will terminate in which rooms (classrooms). This is both to give an idea of contractor cableplant design, as well as to facilitate future troubleshooting.

4. At the request of the ETIS Engineer, the telecommunications contractor shall provide copies of the original test results in tester native format, not spreadsheet.

5. ETIS may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by ETIS, including a 100% re-test. This re-test shall be at no additional cost to the Glendale Unified School District.

E. Test Results

1. Documentation shall be provided in electronic format within three weeks after the completion of the project. The media shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year).

2. The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). Documentation shall also include test equipment name, manufacturer, model number, serial number, software version and last factory calibration date.

3. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation.

4. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

5. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the telecommunications contractor may furnish this information in electronic form.

6. The media shall contain the electronic equivalent of the test results as defined by the specification along with the software necessary to view and evaluate the test reports.

7. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

8. The As-Built drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document shall identify outlet locations.

9. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. Glendale Unified School District will provide floor plans in paper and electronic (DWG, AutoCAD) formats on which as-built construction information can be added.

10. These documents will be modified accordingly by the Telecommunications Contractor to denote as-built information as defined above and returned to the Glendale Unified School District.

11. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD) form.

<END OF SECTION>

Appendix A – Materials List

Manufacturer	Part Number	Description
		COPPER DISTRIBUTION
Panduit	**MWBA1**	Single-gang faceplate brackets – "box eliminators". An alternative for single gang in-wall box in communication applications. Mounting hole spacing of 3.28" (83.5mm).
Panduit	**MWBA-2G**	Double-gang faceplate brackets – "box eliminators". An alternative for double gang in-wall boxes in communication applications. Mounting hole spacing of 3.28" (83.5mm).
Panduit	**CFPL2IWY**	Single gang, vertical faceplate accepts three Mini-Com ® Modules.
Panduit	**CFPL4IWY**	Single gang, vertical faceplate accepts four Mini-Com ® Modules.
Panduit	**CFPL6IWY**	Single gang, vertical faceplate accepts six Mini-Com ® Modules.
Panduit	**CMBIW-X**	Mini-Com blank module to blank out open spaces (holes) on faceplates and patch panels. For colors other than International White, replace "IW" with BL (Black) with EI (Electric Ivory), WH (White), or IG (International Gray).
Panduit	**CBXJ2IW-A**	Surface mount box accepts one or two Mini-Com ® Modules; includes built-in removable blank to add a second module. Dimensions: 0.91"H x 1.77"W x 2.44"L (23.11mm x 44.96mm x 61.98mm). Knockout provides opening of 0.47"H x 0.36"W.
General Cable	**7141819**	Category 6A, plenum (CMP), 4-pair, UTP copper cable, Copper conductors are 23 AWG with FEP insulation, Conductors are twisted in pairs, separated by an integrated pair divider, and protected by a low-smoke flame-retardant PVC jacket, 0.250" diameter. Blue Jacket
General Cable	**2131752E**	25 pair, plenum rated, Category 5E cable – gray.
Panduit	**CPPLA24WBLY**	24-port angled patch panel with labels, supplied with six factory installed CFFPL4 type front removable snap-in faceplates.
Panduit Panduit	**CPPLA48WBLY** **CPP48HDBLY**	48-port angled patch panel with labels, supplied with twelve factory installed CFFPL4 type front removable snap-in faceplates. Panduit High Density 48 port flat Modular Patch Panel. Populate with Blue Cat 6A Mini-Com jacks.
Panduit	**CPPl48WBLY**	48-port flat patch panel with labels, supplied with twelve factory installed CFFPL4 type front removable snap-in faceplates. Populate with Blue Cat 6A Mini-Com jacks.
Panduit	**CJ6X88TGBL**	Category 6A, RJ45, 10 Gb/s, 8-position, 8-wire universal module. Includes patented MaTriX split foil tape. For other standard colors, replace "BL" (Black), with IW (Off White), with EI (Electric Ivory), WH (White), AW (Arctic White), IG (International Gray), OR (Orange), RD (Red), BU (Blue), GR (Green), YL (Yellow), or VL (Violet).
Panduit	**UTP28X*BU**	Category 6A/Class EA, UTP, small diameter patch cords shall be constructed of 28 AWG, unshielded, twisted pair, solid copper (dual-rated CM/LSZH) cable with high performance modular plugs. For lengths 1 to 50 feet (increments of one foot), replace * with desired length in feet. For standard cable colors other than Off White, replace "BU" (Blue) with color code: BL (Black), RD (Red), YL (Yellow), GR (Green), OR (Orange), GY (Gray), PK (Pink), or VL (Violet). Cable diameter: 0.185 in. (4.7mm) nominal. No suffix designates Off White
		FIBER DISTRIBUTION SYSTEMS
Panduit	**FSLP912**	12-fiber OS2 9/125µm singlemode plenum (OFNP) interlocking aluminum armored, indoor/outdoor cable with tight buffered fibers.
Panduit	**FSLP924**	24-fiber OS2 9/125µm singlemode plenum (OFNP) interlocking aluminum armored, indoor/outdoor cable with tight buffered fibers.
Panduit	**FSLP948**	48-fiber OS2 9/125µm singlemode plenum (OFNP) interlocking aluminum armored, indoor/outdoor cable with tight buffered fibers.

Panduit	**FLCDSCBUY**	LC OptiCam® Singlemode Duplex Fiber Optic Connector for 900µm tight-buffered fiber installation.
Panduit	**FCE1U**	Opticom® QuickNet™ Rack Mount Fiber Enclosures, holds up to four QuickNet™ Cassettes, FAP adapter panels, or FOSM splice modules. Dimensions: 1.73"H x 17.60"W x 16.30"D (43.9mm x 447.0mm x 414.0mm).
Panduit	**FCE2U**	Opticom® QuickNet™ Rack Mount Fiber Enclosures, holds up to eight QuickNet™ Cassettes, FAP adapter panels, or FOSM splice modules. Dimensions: 3.48"H x 17.60"W x 16.30"D (88.4mm x 447.0mm x 414.0mm).
Panduit	**FAP6WBUDLCZ**	LC FAP loaded with six LC duplex singlemode fiber optic adapters (Blue) with zirconia ceramic split sleeves.
Panduit	**FAPB**	Blank fiber adapter panel – reserves space for future use.
Panduit	**F92ERQNQNSNM001**	OS1/OS2 2-fiber, riser-rated, LC push-pull to LC push-pull, singlemode patch cord with custom push-pull strain relief boot and duplex clip, 1.6mm jacket, Std. IL. *** At end of part number is for length in meters. Comes in 1 M increments up to 20 meters, then in lengths of 20 M, 25 M, 30 M, and 35 M. Put length in the following (3 digit) format: 001 for 1 M, 020 for 20 M, etc.
		RACKS AND CABLE MANAGERS
Panduit	**R2P**	19" EIA 2-post rack, aluminum. Dimensions: 84.0"H x 20.3"W x 3.0"D (2134mm x 514mm x 76mm).
Panduit	**R2PPEVWF**	Waterfall Trough for 2 Post Rack and PatchRunner high capacity ™ Vertical Cable Managers. FOR TOP-OF-RACK INTERBAY ROUTING.
Panduit	**PEV6**	High capacity dual-sided vertical manager. Dimensions: 83.5"H x 6.0"W x 28.1"D(2120mm x 152mm x 714mm).
Panduit	**PED6**	Dual hinged metal door. Dimensions: 82.8"H x 6.1"W x 1.7"D (2103mm x 155mm x 43mm).
Panduit	**PEV8**	High capacity dual-sided vertical manager. Dimensions: 83.5"H x 8.0"W x 28.1"D (2120mm x 203mm x 714mm).
Panduit	**PED8**	Dual hinged metal door. Dimensions: 82.8"H x 8.1"W x 1.7"D (2103mm x 206mm x 43mm).
Panduit	**PEV10**	High capacity dual-sided vertical manager. Dimensions: 83.5"H x 10.0"W x 28.1"D (2120mm x 254mm x 714mm).
Panduit	**PED10**	Dual hinged metal door. Dimensions: 82.8"H x 10.1"W x 1.7"D (2103mm x 256mm x 43mm).
Panduit	**WMPV45E**	NetRunner™ Vertical Cable Manager, front and rear, 45 RU, 4"W, with covers
Panduit	**NM1**	Horizontal Cable Manager High Capacity Front and Rear 1 Rack Unit. 1.7"H x 19.0"W x 13.1"D (44mm x 482mm x 332mm).
Panduit	**NM2**	Horizontal Cable Manager High Capacity Front and Rear 2 Rack Units. 3.5"H x 19.0"W x 13.1"D (88mm x 482mm x 332mm).
Panduit	**NMF3**	Horizontal Cable Manager High Capacity Front Only 3 Rack Units. 5.2"H x 19.0"W x 6.2"D (133mm x 482mm x 157mm). FOR MID-RACK INTERBAY ROUTING.
Panduit	**CMUT19**	2 RU upper trough with 1.3" bend radius mounts to the top of a standard 19" EIA rack. Dimensions: 3.5."H x 19.0"W x 4.5"D (89mm x 483mm x 114mm). FOR BOTTOM-OF-RACK INTERBAY PATHWAY.
Panduit	**CMLT19**	4 RU lower trough with 1.3" bend radius mounts to the bottom of a standard 19" EIA rack. Dimensions: 8.0"H x 19.0"W x 4.5"D (203mm x 483mm x 114mm). FOR BOTTOM-OF-RACK INTERBAY PATHWAY. LARGER OPTION THAN CMUT19 IF NEEDED.
		WALL MOUNT CABINETS
Hoffman	**EWMW242430**	Accessplus Cabinet with window door, 12 Rack Units, 23.62”H x 23.62”W x 30.01”D
Hoffman	**EWMW362430**	Accessplus Cabinet with window door, 19 Rack Units, 36.02”H x 23.62”W x 30.01”D
		CABLE PATHWAYS

Panduit	**J-Pro J-Hook system**	Panduit J-Pro System. Plenum rated composite J-hooks with hardware available for various hardware applications. See www.panduit.com for variations.
Panduit	**LD10IW10-A**	LD10 International White Plastic Raceway, see catalog or www.panduit.com for fittings. For 8' sections order LD10IW18-A. For standard colors other than IW (Off White), replace IW in part number with EI (Electrical Ivory) or WH (White).
Panduit	**JB1IW-A**	Single gang one-piece outlet box with adhesive backing. Box accepts Pan-Way ® Screw-On Faceplates or any NEMA standard single gang faceplate. For use with Pan-Way LD profile raceway. 5.09"L x 3.34"W x 1.75"H (129.4mm x 85.0mm x 44.4mm). Breakouts for 1/2", 3/4", or 1" diameter conduit. For standard colors other than IW (Off White), replace IW in part number with EI (Electrical Ivory) or WH (White).
Panduit	**T702BIW8**	Pan-Way® Twin-70 Raceway Base, 8' sections, For standard colors other than IW (Off White), replace IW in part number with EI (Electrical Ivory) or WH (White).
Panduit	**T70CIW8**	Pan-Way® Twin-70 Raceway Cover, 8' sections, For standard colors other than IW (Off White), replace IW in part number with EI (Electrical Ivory) or WH (White).
Panduit	**T702******	Pan-Way® Twin-70 Raceway Fittings and Accessories
Panduit	**T45BIW8-A**	Pan-Way ® T-45 Raceway Base, 8' sections, For standard colors other than IW (Off White), replace IW in part number with EI (Electrical Ivory) or WH (White).
Panduit	**T45CIW8**	Pan-Way ® T-45 Raceway Cover, 8' sections, For standard colors other than IW (Off White), replace IW in part number with EI (Electrical Ivory) or WH (White).
Panduit	**T45*****	Pan-Way® T-45 Raceway Fittings and Accessories
Panduit	**OFR20OB8**	Beige modular furniture raceway. 8' sections. For fittings, instructions, other colors see www.panduit.com. One-piece single channel low voltage raceway with adhesive tape backing for data cable routing along top of modular furniture partitions.
Panduit	**PCPA13IW**	Communications Pole, 13 feet. For fittings see www.panduit.com.
Panduit	**PCPA11IW**	Communications Pole, 11 feet. For fittings see www.panduit.com.
Panduit	**T70SDB-X**	Communications Pole standard faceplate bracket. For further fittings and accessories see www.panduit.com.
Panduit	**WG12BL10**	12" wide x 10' long pathway section used to carry cables horizontally throughout the system. Snap-on sidewalls attach for job specific height requirements. Uses splice connector WGSPL1218BL to connect straight sections and intersection splice WGINTSPLBL to connect pathways at an intersection. For fittings and accessories see www.panduit.com.
Panduit	**WG18BL10**	18" wide x 10' long pathway section used to carry cables horizontally throughout the system. Snap-on sidewalls attach for job specific height requirements. Uses splice connector WGSPL1218BL to connect straight sections and intersection splice WGINTSPLBL to connect pathways at an intersection. For fittings and accessories see www.panduit.com.
		BONDING AND GROUNDING
Panduit	**ACG24K**	#6 AWG (16mm$_2$) jumper for armored cable diameter up to 0.84" (21.3mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
Panduit	**LCC series**	Panduit two-hole compressing lugs for code conductors in BICSI hole spacing.
Panduit	**HTCT series**	Panduit HTAPs. Must be selected according AWG size of run and tap conductors.
Panduit	**CLRCVR series**	Panduit clear covers for HTAPs. Must be selected according to HTAP being covered.
Panduit	**RGS134-1Y**	Grounding strip (vertical busbar) for newly installed racks or cabinets with screw rails. 78.65" (2m) length; .67" (17mm) width; .05" (1.27mm)thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and

		M6 x 12mm thread-forming screws.
Panduit	**RGCBNJ660P22**	Jumper kit for bonding individual racks or cabinets into grounding backbone. #6 AWG (16mm²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread forming screws and a copper compression HTAP* for connecting to a #6 to #2 awg sized bonding backbone.
Panduit	**GJ672UH**	Rack jumper (and cabinet) kits for smaller TR (5 bays or less) to bond individual rack or cabinet directly back to wall mounted busbar. One 72" length #6 AWG green wire with yellow horizontal stripe. Jumper is pre-terminated on one end with LCC6-14JAWH-L and the other end with LCC6-14JAW-L. This rack grounding jumper is 72" long. For other lengths replace the "72" in the part number. Available lengths are 72, 96, 120, 144, 168, 192, 216, 240, 264 and 288 inches.
Panduit	**RGESD2-1**	Two-hole ESD port with 5/8" hole spacing; provided with an ESD protection sticker, .16 oz. (5cc) of antioxidant, and two each #12-24 x 1/2" and M6 x 12mm thread-forming screws. LOCATE ONE WITHIN REACH OF ALL EQUIPMENT. WORKS WITH WRIST STRAP RGESDWS.
Panduit	**RGESDWS**	Adjustable fabric ESD wrist strap with 6' coil cord, banana plug, 1 megaohm resistor and 4mm snap. LOCATE ONE WITHIN REACH OF ALL EQUIPMENT. WORKS WITH ESD PORT RGESD2-1.
Panduit	**RGTBSG-C**	Green thread-forming bonding screws for use to mount equipment that does not have a built-in grounding pad (terminal).
Panduit	**RGEJ1024PHY**	24" long pre-terminated equipment grounding jumper #10 AWG (6mm²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws. FOR EQUIPMENT LIKE CHASSIS SWITCHES WITH BUILT-IN GROUNDING PAD (TERMINAL).
Panduit	**RGEJ1036PFY**	36" long pre-terminated equipment grounding jumper#10 AWG (6mm²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws. FOR EQUIPMENT LIKE CHASSIS SWITCHES WITH BUILT-IN GROUNDING PAD (TERMINAL).
Panduit	**GB2B0306TPI-1**	Wall mounted telecommunications busbar suitable for small telecom room. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 2" x 12" in size.
Panduit	**GB2B0514TPI-1**	Wall mounted telecommunications busbar suitable for med telecom room. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 2" x 24" in size.
Panduit	**GB4B0624TPI-1**	Wall mounted telecommunications busbar suitable for main grounding busbar in medium sized facility. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 4" x 20" in size.
Panduit	**LTYK**	Wall mounted busbar label kit. Label kit includes printed tag and one flame retardant cable tie.
		NETWORK LABELING SOFTWARE – FOR INK JET/LASER PRINTER
Panduit	**PROG-EM2GO**	Easy-Mark Labeling Software for PC, supplied on USB Flash Drive. For preprinting communications labels on laser/inkjet printer.
Panduit	**S100X150YAJ**	Self-laminating cable labels for Category 6 cable for use with Easy-Mark software and laser/ink jet printer.
Panduit	**C261X035Y1J**	Patch Panel labels for use with Easy-Mark software and laser/ink jet printer.
Panduit	**C195X040Y1J**	Faceplate labels for single gang stainless or sloped plastic - use with Easy-Mark software and laser/ink jet printer.
Panduit	**C288X040Y1J**	Faceplate labels for double gang stainless - use with Easy-Mark software and laser/ink jet printer.
Panduit	**S100X650YAJ**	Cable label for indoor/outdoor tight-buffered armored fiber optic cable. For use with Easy-Mark software and ink jet printer.
Panduit	**S100X160YAJ and NWSLC-3Y**	Label and turn-tell sleeve for labeling fiber jumpers. For use with Easy-Mark software and ink jet printer.

Panduit	**C200X100FJJ**	1" high, white, vinyl tape labels for labeling grounding busbars, racks, cabinets and pathways. For use with laser/ink jet printer.
		NETWORK LABELING – HANDHELD LABELER
Panduit	**LS8EQ-KIT-ACS**	Panduit PanTher hand-held label printing system in kit. Includes LS8EQ printer with QWERTY keypad, one cassette of S100X150VAC self-laminating labels, six AA alkaline batteries, LS8E-ACS, LS8-CASE, LS8-PCKIT, LS8-IB, LS8-WS, quick reference card and operator's manual. USE FOR LABELS THAT MUST BE PRINTED ON THE JOB SITE.
Panduit	**S100X150VAC**	Self-laminating cable labels for Category 6 cable for use with PanTher LS8E hand-held printer.
Panduit	**C261X035Y1C**	Handheld printer labels for modular faceplate patch panels.
Panduit	**C195X040Y1C**	Faceplate labels for single gang stainless - use with PanTher handheld labeler.
Panduit	**C288X040Y1C**	Faceplate labels for double gang stainless - use with PanTher handheld labeler.
Panduit	**S100X650VAC**	Cable label for indoor/outdoor tight-buffered armored fiber optic cable. For use with handheld labeler.
Panduit	**S100X160VAC and NWSLC-3Y**	Label and turn-tell sleeve for labeling fiber jumpers. For use with hand-held labeler.
Panduit	**T100X000VPC-BK**	1" high, continuous black on white, vinyl tape labels for labeling racks, cabinets and pathways with PanTher LS8E handheld labeler.
		PHYSICAL SECURITY LOCKING DEVICES
Panduit	**PSL-DCJB-C**	Package of 100 RJ45 jack blockout devices and one removal tool. Color red.
Panduit	**PSL-USBA-L**	Package of 50 USB Type 'A' blockout devices and one removal tool. Color red.
Panduit	**PSL-USBB-L**	Package of 50 USB Type 'B' blockout devices and one removal tool. Color red.
Panduit	**PSL-DCPLX-BL-C**	Package of 100 RJ45 plug lock-in devices compatible with flush mount jacks, and one installation/removal tool. Color black.
Panduit	**PSL-DCPLRX-BL-C**	Package of 100 RJ45 plug lock-in devices compatible with recessed jacks, and one installation/removal tool. Color black.
		CABLE TIES – HOOK AND LOOP
Panduit	**TTS-35RX0**	.75" wide, continuous roll Hook and Loop Cable Ties, black. 35 ft. roll. Carton qty 10 rolls.
Panduit	**HLSP1.5S-X12**	Plenum rated hook and loop cable ties for air return spaces. Maroon color, perforated at 6" length.
Panduit	**HLSP3S-X12**	Plenum rated hook and loop cable ties for air return spaces. Maroon color, perforated at 6" length.

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