



STRUCTURED CABLING SYSTEM SPECIFICATION

For

**PanGen 10GBASE-T Compliant
Category 6A Cabling Systems**

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Introduction

1.1. Purpose

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable for a PanGen Category 6A and 10GBASE-T compliant copper cabling system for commercial building structured cabling applications.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supersedes and voids all previous literature, etc.

It is highly recommended and the issuer's responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries.

A. Scope of Document

1. The owner of these facilities will be referred to herein as Madera County Office of Education. These guidelines are both to encourage standardization of data all communication configurations and layouts as well as to provide basic information necessary to cabling contractors and installation firms wishing to bid for installation work within these facilities. These installers shall be referred within this document as "Contractor".
2. The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines and makes reference to current, accepted low-voltage cabling Standards.
3. In all instances where Standards are cited, it is assumed Installer will have familiarity with and implicitly follow the recommendations of the most current version of the Standard referenced at the time of installation. Compliance with most current Standards is the sole responsibility of the Contractor.
4. Anywhere cabling Standards conflict with National or local electrical or safety codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either. Knowledge and execution of applicable codes is the sole responsibility of the Contractor. Any code violations shall be remedied at the Contractor's expense.

B. Scope of Work

1. Contractor shall provide all labor, materials, tools and equipment required for the complete installation of work called for in the Construction Documents unless explicitly instructed otherwise by Your company. All deviations from this must be by written instruction from Madera County Office of Education.

2. 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 Madera County Office of Education.
3. Contractor shall provide performance verification testing of all installed links using up-to-date and industry accepted test equipment appropriate to the types of links being tested. All testers used shall be factory calibrated within one year of use with references set daily prior to testing.
4. Contractor shall provide valid test data in electronic format and hard copy indicating passing of all installed links according to applicable Standards cited under "Regulatory Requirements" section of this document. Madera County Office of Education reserves the right to require more stringent test requirements than those cited in the Standards. Such requirements will be requested in writing prior to installation.
5. Final acceptance of the installation shall be in writing by Madera County Office of Education.
6. Contractor shall provide all equipment brands and models are specified within this document.

c. Clarification of specifications and bid documents

1. Quantities of telecommunications equipment, typical installation details, cable routing conventions and support structure types will be provided as an attachment to this document if applicable.
2. If bid documents on specific projects appear to be in conflict, Contractor shall obtain formal clarification in writing from Madera County Office of Education to resolve the conflict.

1.2. Applicable Standards

The following industry standards are the basis for the structured cabling system described in this document. The list is incorporated by this reference to them.

1.2.1. TIA/EIA

- TIA/EIA-568-C (Commercial Building Telecommunications Cabling Standard)
- TIA/EIA-569-A (Commercial Building Standard for Telecom, Pathways and Spaces)
- TIA/EIA-606 (Administration Standard for the Telecommunications, Infrastructure of Commercial Buildings)
- TIA/EIA-607 (Commercial Building Grounding/Bonding Requirements)

1.2.2. NFPA

- NFPA-70 (National Electric Code (NEC) -1999)

1.2.3. ISO/IEC

- ISO/IEC 11801 (Generic Cabling for Customer Premises)

1.2.4 IEEE

- 802.3an (Physical Layer and Management Parameters for 10 Gb/s Operation, Type 10GBASE-T)

The most recent versions of all documents apply to this project.
If there is a conflict between applicable documents, the order above shall dictate the order of precedence in resolving the issue unless an enforceable local or national code is in effect.

1.3. Additional Support

1.3.1. [Panduit® CERTIFICATION PLUS™ System Warranty](#)

A **CERTIFICATION PLUS** System Warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of 25 years.

1.3.2. Panduit® PCI Contractor Agreement

A factory registered [Panduit PCI contractor](#) shall complete network installation. The contractor shall have completed standards based product and installation training. **A copy of the PCI Contractor Certificate** shall be submitted in the proposal.

1.3.3. [Product Guarantee](#)

All Panduit PAN-NET® non-consumable products have a 25-year guarantee. When installed per TIA or ISO/IEC standards, the Panduit PAN-NET® Network Cabling System will operate the application(s) for which the system was designed to support. Applications may include, but are not limited to:

10GBASE-T Ethernet (IEEE 802.3an)

10/100/1000 Mbps Ethernet (IEEE 802.3)

In order to qualify for the guarantee, the structured cabling system must be installed per the following:

1. Meet all TIA/EIA commercial building wiring standards
2. Panduit categorized product must be used in conjunction with an equivalent or higher Category UL or ETL verified cable.
3. Panduit Products must be installed per Panduit instruction sheets.

Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.

If any Panduit PAN-NET® product fails to perform as stated above, Panduit will provide new components at no charge.

THIS GUARANTEE IS MADE IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE ARE SPECIFICALLY EXCLUDED Neither seller nor manufacturer shall be liable for any other injury, loss or damage, whether direct or consequential.

PART 3 QUALITY ASSURANCE

Contractor Qualifications

Any contractor offering a proposal for an Your companys data center project must meet the minimum requirements listed below. Contractors shall also provide written, hard copy documentation of these qualifications with their proposals.

3. Be a Panduit Corp. PCI (Panduit Certified Installer) Design and Installation Contractor.
4. Have on staff an RCDD or equivalent, with equivalency being at the sole discretion of Panduit Corp. (This is for Warranty purposes).
5. Have a minimum of 3 years in the communications structured cabling business.
6. Have design and installation of communications structured cabling systems as their primary line of business.
7. **Must provide a current 2011 Panduit PCI certificate at time of bid.**

System Performance Warranty

8. Contractor shall provide a Panduit **CERTIFICATION PLUS** System Warranty on all installed copper and fiber permanent/channel links. Such warranty shall provide a complete system warranty to guarantee high end-to-end performance for all applications designed to operate over the class of cabling installed. The guarantee shall include all connectivity components and cable within the permanent/channel link and cover the system for duration of 25 years.

Approved Products (No substitutes or equals)

- A. Approved UTP 4-pair Cable: General Cable
- B. Approved Optical Fiber Cable manufacturer: General Cable
- C. Approved UTP connector product manufacturer: Panduit
- D. Approved Fiber Optic enclosure product manufacturer: Panduit
- E. Approved Fiber Optic connectors/splices/couplers: Panduit
- F. Approved Rack and Cabinet manufacturer: Panduit/Hoffman/APC
- G. Approved Patch Panel manufacturer: Panduit
- H. Approved UTP Patch Cord manufacturer: Panduit

Part 4 Products

EQUIVALENT PRODUCTS

A. Equivalent Products

- The nature of communications at Madera County Office of Education necessitates that all physical layer infrastructure elements operate as an integrated whole. Therefore, all such appliances, devices and components shall be manufactured by Panduit as called out in this document unless substitutions are expressly approved in writing from Your companys/Unified Communications/IP Facilities Team according to the "Substitutions" procedure outlined below. This is including but not limited to support structures such as racks and cabinets, plastic and metal delivery systems such as overhead trough and under-floor basket-trays, cable management appliances, faceplates, copper modules, patch panels, racks, 110 blocks, patch cords, labels, grounding lugs and fiber connectivity products.
- All copper and fiber cables shall be manufactured by Panduit/General as specified herein. Any contractor wishing to substitute product shall follow procedures outlined in "substitutions" section below.

B. Substitutions

- This is a performance-based single source solution. Therefore, substitutions are highly discouraged. Substitutions must follow the same rigid standards for quality and termination style as those products specified herein. Proof of equivalency is the responsibility of the Contractor and must follow the procedure below.
- *Any Contractor wishing to offer structured cabling products other than those specified shall submit a request for product substitution in writing no less than 14 days in advance of bid. Written requests for substitution shall be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalency in electrical and mechanical performance, as well as adherence to the product features and manufacturing style outlined in this document.*
- This written documentation shall be accompanied by three (3) each samples of the substitution product being offered for evaluation. Equal product acceptance must be received from Madera County Office of Education in writing.
- Contractor shall be responsible for and 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.

Documentation:

Installation documentation must include "as built" drawings. These drawings shall be supplied to the Madera County Office of Education no later than two weeks after completion of the DATACOM installation. Each wall plate shall have a mechanically produced label for visible identification of port number and location of IDF termination (Panduit Label maker LS9). Hand written identification will not be acceptable. Each outlet will need to be documented on "as built".

Any deviation from the manufactures specifications and guidelines must be noted and submitted by the vendor in writing.

2. Telecommunication Network System Requirements

2.1. Description

The Copper structured Cabling System shall consist of any one or all of the following structured cabling elements or subsystems:

- Work area
- Horizontal cabling
- Telecommunications room (or horizontal cross connect)
- Backbone cabling
- Equipment room
- Entrance facility
- All cable support structure

2.2. Supported applications

The Copper Structured Cabling System shall be capable of supporting and/or integrating the following:

- Analogue and digital voice applications
- Data applications
- Local area network services
- Wide area network services
- Video services
- Low voltage devices for building controls

The applications that shall be supported include, but are not limited to:

Data Communications

- Ethernet (10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T)
- Any other application designed to run on a generic structured cabling system designed and installed to TIA or ISO structured cabling standards.

Building Services

- Heating, ventilation, and air conditioning (HVAC) monitoring and control
- Lighting
- Motion sensors
- Public address and paging systems
- Security
- Other low voltage devices

Multiple Services

- The structured cabling system shall also support backward and forward migration of applications with minimal disruption to existing services or personnel, allowing for quick moves, adds, and changes.

2.3. Additional requirements

- In order to be 10GBASE-T channel compliant, all components of the cabling system must be PanGen 10Gig product unless other-wise approved or authorized by Panduit.
- All structured cabling products shall be installed according to any applicable instructions.

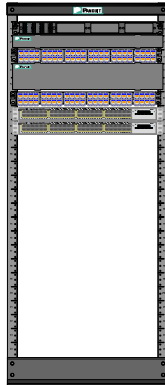
- All networks and other applications shall be installed per applicable standards and manufacturers' guidelines and transmitted over the appropriate minimum Category copper cable or fiber cable for which it was intended to operate on.
- All applicable local, state, national, and federal electrical and fire safety standards shall be adhered to during and after installation.

Project Requirements

This Project consists of 6 Idf's and 1 MDF The individual characteristics of each location is noted below. Please note that these items are manufacturer recommendations. If said contractor believes other Panduit branded products are better suited for the installation please feel free to list them on your bid submission for consideration by the Madera County Office of Education .

Please See Appendix A for a complete Parts list.

The illustration below depicts a typical IDF



Wall Mount Rack

Additional items- Each IDF will consist of the abovementioned parts. There is a possibility for some differration which will be outlined in the satement of work if necessary.

Draft MDF Layout



3. Work Area Subsystem

The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:

- Patch (equipment) cords and modular connectors
- Outlets and surface mount boxes
- Consolidation point / MUTOA

3.1. Patch Cords and Modular Connectors

The modular connectors and patch cords will be chosen to match the horizontal cabling medium and rating. The same manufacturer shall provide the modular connectors and patch cords. The total patch cord length at the work area is not to exceed 3 meters (10 ft). Exception: When implementing an open office cabling system as specified under TIA/EIA TSB-75 (see section 3.4).

3.2. Category 6A Copper Components

The PanGen Network Cabling System or equivalent shall be used for the Work Area subsystem, including all modular connectors. The network cabling system shall be comprised of modular connectors in support of high-speed networks and applications designed for implementation on copper cabling. All outlets shall utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds and changes.

3.1.2 Category 6A UTP Modular Jacks

MINI-COM® TX6A™ 10GIG™ UTP Jack Modules shall be Category 6A modules featuring Giga - TX Technology. The eight position modules shall terminate unshielded twisted 4 pair, 22 – 26 AWG, 100 ohm cable and shall not require the use of a punchdown tool. Jack module shall use Enhanced Giga-TX™ Technology with forward motion termination to optimize performance by maintaining cable pair geometry and eliminating conductor untwist. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/8" (3.18 mm) and include a wiring scheme label. The blue module base shall signify Category 6A performance and shall include a universal label representing T568A and T568B wiring schemes. The TX6A 10Gig jack modules shall be universal in design, including complying with the intermateability standard IEC 60603-7 for backward compatibility. Category 6A jack modules shall be UL and CSA approved and RoHS compliant.

The jack modules shall be ETL verified to ANSI/TIA/EIA Category 6A and IEC/ISO 11801 Class E_A channel performance. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts. The jack modules shall be able to be re-terminated a minimum of 20 times and be available in 11 standard colors for color-coding purposes. The jack module shall snap into all MINI-COM® outlets, patch panels and surface mount boxes. The MINI-COM® TX6A™ 10GIG™ Jack Module must be installed as part of a complete TX6A™ 10GIG™ Copper Cabling System with Mosaic Technology in order to achieve 10GBASE-T certified performance.

Part number	Style	Category	Colors
CJ6X88TG**	RJ-45	6A	11

**To designate a color, add suffix IW (Off White), EI (Electric Ivory), IG (Int'l Gray), WH (White), BL (Black), OR (Orange), RD (Red), BU (Blue), GR (Green), YL (Yellow) or VL (Violet)

3.1.2.1 Modular Jack Reliability Requirements

Mechanical Test	Test Method	Measurement	Typical Test Results
Normal Force	—	Load (grams)	>100
Vibration	IEC 512-6d	Circuit Resistance (mOhms)	<40
Shock	IEC 512-6c	Contact Disturbance (microseconds)	<5
Durability	IEC 512-9a	Circuit Resistance (mOhms)	<40
Mating/Un-Mating	IEC 512-13b	Mating Force (N)	<20
		Un-Mating Force (N)	<20
Termination Cycles	IEC 352	Number of Cycles	>20

Electrical Test	Test Method	Measurement	Typical Test Results
Low Level Circuit Resistance	IEC 512-2a	Resistance (mOhms)	<20
Dielectric Withstand Voltage	IEC 512-4a	1000 V, 1 minute	Passed
Insulation Resistance	IEC 512-3a	Resistance (mOhms)	>500

Environmental Test	Test Method	Measurement	Typical Test Results
Temperature Life	IEC 512-9b	Circuit Resistance (mOhms)	<40
Humidity	IEC 512-11c	Circuit Resistance (mOhms)	<40
Thermal Shock	IEC 512-11d	Circuit Resistance (mOhms)	<40
Climatic Sequence	IEC 512-11a	Circuit Resistance (mOhms)	<40
Flowing Mixed Gas Corrosion	IEC 512-11g	Circuit Resistance (mOhms)	<40

3.1.2.2 Modular Jack Quality Control

Jack modules shall be 100% performance tested for continuity, crosstalk, insertion loss, and return loss. All lots and individual jacks shall be serialized for future traceability.

3.1.2.3 Standard Packaging

Standard Packaging Quantity: 1 jack per bag, 24 per bag or 50 jacks per carton.

3.1.3 [Category 6A UTP Patch Cords](#)

TX6A™ 10GiG™ Patch Cords shall be constructed with Category 6A 23-AWG stranded cable featuring MaTriX Tape Technology. Patch Cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. TX6A™ 10GiG™ Patch Cords have incorporated MaTriX Tape and a foam tape barrier into the patch cable design to help suppress alien crosstalk and improve internal electrical performance. Patch cords shall be wired to be compatible with both T568A and T568B wiring schemes. The patch cords shall come in standard lengths of three to twenty feet (one foot increments) and twenty-five to fifty feet (five foot increments). The patch cords are available in eight standard colors of White, Blue, Yellow, Green, Black, Red, Violet, and Orange.

The patch cords shall be ETL verified ANSI/TIA/EIA Category 6A and IEC/ISO 11801 Class E_A channel performance. Each patch cord shall be 100% performance tested at the factory in a channel test to the ANSI/TIA/EIA and IEC/ISO standards. The TX6A™ 10GiG™ Patch Cords must be installed as part of a complete TX6A™ 10GiG™ UTP Copper Cabling System in order to achieve 10GBASE-T certified performance.

Part Number	Length (Ft)	Length (m)
UTP6A3**	3	0.91
UTP6A5**	5	1.52
UTP6A7**	7	2.13
UTP6A9**	9	2.74
UTP6A14**	14	4.27
UTP6A20**	20	6.10

* Patch cords shall come in standard lengths of 3 to 20 feet (one foot increments) and 25 to 50 feet (5 foot increments).

** Available in eight standard colors of Blue (BU), White (WH), Yellow (YL), Green (GR), Black (BL), Red (RD), Violet (VL) or Orange (OR).

3.1.3.1 Category 6A Patch Cord Quality Control

Patch Cords shall be 100% performance tested for continuity, crosstalk, insertion loss, and return loss. All lots and individual patch cords shall be serialized for traceability.

3.1.3.2 Standard Packaging

Standard Packaging Quantity: 1 cord per bag, and 10 bags per carton.
Coil diameter is to comply with control drawing and BOM.
Twist Tie shall be used to constrain coil.

3.3. Outlets and Surface Mount Boxes

The outlets and surface mount boxes shall support the network system by providing high-density in-wall, surface mount or modular office furniture cabling applications. The outlets consist of faceplates for flush and recessed in-wall mounting as well as mounting to the modular office furniture systems. The surface mount boxes can be mounted where in-wall applications are not possible or to support applications where surface mount is the best option.

All outlets shall fully utilize the interchangeable and individual MINI-COM® connector modules that mount side by side to facilitate quick and easy moves, adds and changes. All outlets shall be manufactured from high-impact thermoplastic material with a U.L. flammability rating of 94 HB or better. Most outlets and surface mount boxes shall be available in 5 colors including Off White (IW), Electrical Ivory (EI), White (WH), International Gray (IG) and Black (BL).

3.3.1. Faceplates

[MINI-COM® Executive Series Faceplates](#) shall be 1, 2, 4 and 6 port vertical single gang and 10 port vertical double gang faceplates with combination head screws, screw covers, labels, label covers and a curved, designer appearance. The faceplates shall mount to standard U.S. NEMA boxes and adapters with screw to screw dimensions of 3.28" (83.3mm). The insert labels shall meet UL 969. Each faceplate shall accept MINI-COM® Jack Modules that can be individually inserted and removed as required.

Part number	Gang	Number of Modules
CFPE1**Y	Single	1
CFPE2**Y	Single	2
CFPE4**Y	Single	4

CFPE6**Y	Single	6
CFPE10**-2GY	Double	10

** - designates color

[MINI-COM® Classic Series Faceplates](#) shall be 1, 2, 3, 4 and 6 port vertical single gang and 2 and 4 port horizontal, single gang faceplates with painted combination head screws. The faceplates shall mount to standard U.S. NEMA boxes and adapters with screw to screw dimensions of 3.28" (83.3mm). Faceplates shall be available with or without labels. Dedicated sloped versions shall be available for improved bend radius control and decreased requirements in wall depth. Each faceplate shall accept MINI-COM® Jack Modules that can be individually inserted and removed as required.

Part number	Orientation	Labels included	Number of Modules
CFP1**	Vertical	No	1
CFP2**	Vertical	No	2
CFPL2**Y	Vertical	Yes	2
CFPSL2**Y	Vertical	Yes	2 sloped
CFPL3**Y	Vertical	Yes	3
CFP4**	Vertical	No	4
CFPL4**Y	Vertical	Yes	4
CFPSL4**Y	Vertical	Yes	4 sloped
CFPL6**Y	Vertical	Yes	6
CFPSL6**Y	Vertical	No	6
CFPH2**	Horizontal	No	2
CFPHS2**	Horizontal	No	2 sloped
CFPH4**	Horizontal	No	4
CFPHSL4**	Horizontal	Yes	4 sloped

** - designates color

3.3.2. Modular Furniture Faceplates

[MINI-COM® Modular Furniture Faceplates](#) shall be 4 port flat or 2 port angled faceplates that snap directly into TIA/EIA standard furniture openings. The 2 port, angled faceplate shall provide a 45° slope to the side, in-line with the cable running through the furniture channel. If required, an extender shall be used with the 4 port flat faceplate to provide 12.7 mm (0.5") additional depth. Each faceplate shall accept MINI-COM® Jack Modules that can be individually inserted and removed as required.

Part number	Number of Modules	Orientation
CFFP4**	4	Flat
CFFPA2**	2	Sloped
CFFPL4**	4	Flat with Label

** - designates color

3.3.3. Faceplate Frames and Inserts

[MINI-COM® Executive Series Faceplate Frames](#) shall be vertical, single and double gang frames with combination head screws, screw covers, labels, and a curved designer appearance. The faceplates shall mount onto standard U.S. NEMA boxes and adapters with screw to screw dimensions of 3.28" (83.3mm). Each faceplate frame shall accept flat, sloped, sloped shuttered, sloped recessed and blank 1/2 and 1/3 size module inserts that can be individually inserted and removed as required from the front of the frame without removing the frame.

Part number	Gang	Number of Modules
CBE**Y	Single	Up to 6
CBE**-2GY	Double	Up to 12

** - designates color

[MINI-COM® Classic Series Faceplate Frames](#) shall be vertical, single and double gang frames with painted combination head screws. The faceplates shall mount onto standard U.S. NEMA boxes and adapters with screw to screw dimensions of 3.28" (83.3mm). Each Faceplate Frames shall accept flat, sloped, sloped shuttered, sloped recessed and blank 1/2 and 1/3 size module inserts that can be individually inserted and removed as required from the front of the frame without removing the frame.

Part number	Gang	Number of Modules
CB**	Single	Up to 6
CB**-2G	Double	Up to 12

** - designates color

[MINI-COM® 1/2 or 1/3 size, sloped / sloped recessed / flat / sloped shuttered / blank inserts](#) shall be used in all faceplate frames and be removable from the front of the frame using a small standard screwdriver without the need to remove the faceplate frame. Each insert shall accept individual connector modules that can be individually inserted and removed as required. The shuttered inserts shall include a spring-loaded shutter that automatically closes when released. The sloped and recessed inserts shall provide a 45° downward slope to provide adequate bend radius and connector protection both in front and in the rear of the faceplate frame.

Part number	Orientation	Size	Number of Modules
CHS2**-X	Sloped	1/2	2
CHS1S**-X	Sloped with shutters	1/2	1
CHS2S**-X	Sloped with shutters	1/2	2
CHF2**-X	Flat	1/2	2
CHSR2**-X	Sloped recessed	1/2	2
CHF2M**-X	Flat	1/3	2
CHB2**-X	Flat blank	1/2	0
CHB2M**-X	Flat blank	1/3	0

** - designates color

3.3.4. Stainless Steel Faceplates

[MINI-COM® Stainless Steel Faceplates](#) shall be 2, 4 and 6 port vertical single gang and 4, 8 and 10 port double gang faceplates with combination head stainless steel screws. The faceplates shall mount to standard U.S. NEMA boxes and adapters with screw-to-screw dimensions of 3.28" (83.3mm). Faceplates shall be flush mounted for clean look. Stainless steel material shall be riveted to high impact ABS backing to provide a durable faceplate with brush finish. Each faceplate shall accept individual copper connector modules that can be individually inserted and removed as required.

Part number	Gang	Number of Modules
CFP2SY	Single	2
CFP4SY	Single	4
CFP6SY	Single	6
CFP4S-2GY	Double	4
CFP8S-2GY	Double	8
CFP10S-2GY	Double	10

3.3.5. [Surface Mount Boxes](#)

MINI-COM® Low Profile Surface Mount Boxes shall be 1, 2, 4, 6 and 12 port low profile surface mount boxes with a 28 mm (1.1") maximum height. All connections (with exception of the 12 port low profile box) shall exit one side of the box, parallel to the wall. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The 2 port boxes shall include a removable blank for addition of a second port. The 4, 6 and 12 port boxes shall include breakouts for use with PAN-WAY® surface raceway and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The 4 (except low profile 4), 6, and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels. Each box shall accept individual MINI-COM® Jack Modules that can be individually inserted and removed as required.

Part number	Number of Modules	Maximum Height
CBX1**-A	1	23 mm
CBXJ2**-A	2	23 mm
CBX2**-AY	2	27mm
CBXC4**-A	4	23 mm
CBX4**-AY	4	28 mm
CBXD6**-AY	6	26 mm
CBX12**-AY	12	26 mm

** - designates color

3.3.6. Other Outlet Components

[MINI-COM® “106” Frames](#) shall be a 2 or 4 port frame that mounts onto U.S. NEMA standard junction boxes and wall board adapters with screw-to-screw dimensions of 3.28" (83.3mm) and behind NEMA standard “106” duplex electrical faceplates. Frame shall accept individual modules that can be individually inserted and removed as required.

[MINI-COM® “GFCI” Frames](#) shall be 1, 2, and 4 port frames that mount to board adapters and behind NEMA standard “GFCI” electrical faceplates. Each frame shall accept individual connector modules that can be individually inserted and removed as required.

Part number	Number of Modules	Frame Type
CFG1**	1	GFCI
CFG2**	2	GFCI
CFG4**	4	GFCI
CF1062**Y	2	106 Duplex
CF1064**Y	4	106 Duplex

** - Designates color

3.4. MUTOA/Consolidation Points (If Necessary)

Consolidation Point and MUTOA (Multi-User Telecommunication Outlet Assembly) configurations shall be implemented in open office applications where the office area is split into zones and the cabling system utilizes short runs from an intermediate connection to facilitate frequent moves, adds and changes (MACs) as specified per TIA/EIA-568-B. The MUTOA and consolidation point equipment will be chosen to match the horizontal cabling medium and performance category. The same manufacturer shall provide the modular connectors and patch cords.

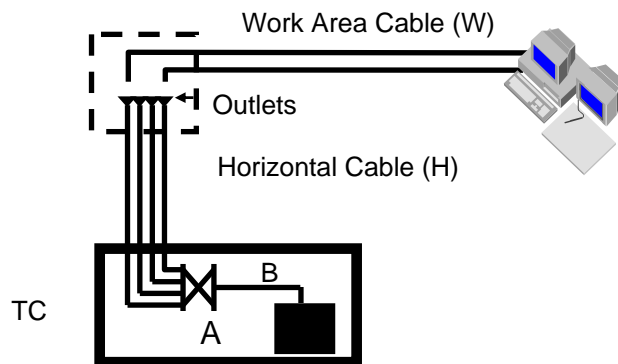
Maximum length of horizontal and work area cables

Horizontal Area Cable (H)	Max Combined Length of Patch Cords, Work Area & Equip. Cable (C)	Max Work Area Cable Length (W)
90 m (295 ft)	10 m (33 ft)	5 m (16 ft)
85 m (279 ft)	14 m (46 ft)	9 m (30 ft)
80 m (262 ft)	18 m (59 ft)	13 m (44 ft)
75 m (246 ft)	22 m (72 ft)	17 m (57 ft)
70 m (230 ft)	27 m (89 ft)	22 m (71 ft)

Formulas: $C = (102 - H)/1.2$ $W = C - 5, <22m$

3.4.1. MUTOA Assemblies (If Necessary)

MUTOA assemblies represent optional cabling practices for Open office environments. The Horizontal Cables shall be terminated in a common location. Patch cords are then routed directly from the MUTOA to the work area equipment. Shall be used in applications in which frequent moves are anticipated. Each MUTOA shall serve no more than 12 work areas. The MUTOA shall be fully accessible and permanently mounted. The MUTOA shall not be located in ceiling areas.



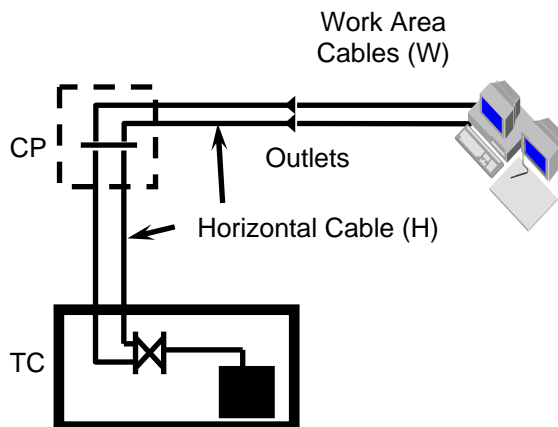
MUTOA assemblies shall use [MINI-COM® Fiber/Multi-Media Surface Mount Boxes](#). The Surface Mount Boxes shall be 6 and 12 port surface mount boxes with all connections exiting one side of the box, parallel to the wall. The 6 and 12 port boxes shall contain a “captive” fiber spool that maintains a minimum 25.4 mm (1”) bend radius. The 6 and 12 port boxes shall store up to 24 meters of buffered optical fiber. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The boxes shall include breakouts for use with PAN-WAY™ surface raceway on three sides and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The 6 and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels. Each box shall accept individual connector modules that can be individually inserted and removed as required.

Part number	Number of Modules	Maximum Height
CBXF6**-AY	6	25 mm
CBXF12**-AY	12	46 mm

** - designates color option

3.4.2. Consolidation Points

A Consolidation Point (CP) serves as a connection between horizontal cabling and the work area cabling especially in modular furniture pathways. Consolidation Points is not a user interface and preferred for applications where moves are anticipated. No more than one CP is allowed in each horizontal cable run. The recommended location of the CP is greater than 15 meters from the Telecommunications Closet (TC) to reduce Near-end Cross Talk (NEXT). Each CP shall be easily accessible, permanently mounted and serve no more than 12 work areas. Products shall include, but not be limited to:



[PANZONE™ Enclosures](#) – For Future-Consolidation Points shall use Zone Cabling Enclosures to separate the barriers of plenum and non-plenum environments and the workspace. In-floor boxes shall be available in multiple sizes and mount into the allocated space for standard 24" x 24" raised floor panels, minimum 6" depth. In-ceiling boxes shall be available to accommodate 2' x 6' and 2' x 4' ceiling grids. All zone boxes shall support standard 19" patch panels and are plenum rated. Each opening shall accommodate 96 4-pair UTP cables. The boxes shall be made of 14-gauge aluminum.

Part number	Mounting Location	Max Number of Rack Units
PZRFE4	Raised floor	4
PZRFE8	Raised floor	8
PZRFE12	Raised Floor	12
PZICE	Drop ceiling	5 – 8

Wall-Mounted Modular Jack Consolidation Points - Consolidation Points shall use *MINI-COM®* 12 Port Snap-In Faceplate Patch Panels. The Patch Panel shall have 12 port capacities. The patch panel shall accept all *MINI-COM®* Jack Modules for UTP, STP, Coax and fiber. The Patch Panel shall provide spacing behind the modules for routing cables and maintaining proper bend radius. Patch Panels shall provide for horizontal or vertical mounting to walls and ceiling using an integrated mounting frame.

Part number	Number of Ports	Wiring Configuration
CWPP12WBL	12	T568A and B

4. Horizontal Cabling Subsystem

The horizontal cabling system is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the TC.

- Horizontal cabling in an office should terminate in a TC located on the same floor as the work area being served
- Horizontal cabling is installed in a star topology (home run)
- Bridged taps and splices are not permitted as part of the copper horizontal cabling

PanGen Category 6A MTP Horizontal Cable

The General Cable GenSpeed 10 MTP Category 6A Cable shall meet or exceed both channel and component compliant standards (ANSI/EIA/TIA-568-B.2-10, & 568-C IEC/ISO 11801 Class E_A (channel) and IEC 61156-6 (component) standards). Category 6A UTP 4-pair copper cable shall be constructed of 23 AWG conductors. The insulated conductors shall be twisted in pairs and all four pairs shall be covered by a flame retardant PVC, FEP, or PE jacket depending on cable flame rating. The copper conductors shall be twisted in pairs and separated by a crossweb. All four pairs shall be surrounded by Mosaic Crossblock Tape and flame retardant jacket. The patent pending

Mosaic Tape shall suppress the effects of alien crosstalk allowing 10Gb/s transmission. This innovative cable design shall provide installation flexibility as cables can be routed in tight bundles through pathways and spaces. The PanGen MTP 6A™ 10GiG™ UTP Copper Cable with Mosaic Crossblock Technology must be installed as part of a complete PanGen MTP 6A™ 10GiG™ Copper Cabling System in order to achieve 10GBASE-T certified performance.

All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. Cable listed to NEC Article 800-51(a) will be used for “Plenum” installations. Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.

General Cable GenSpeed 10 MTP Category 6A Cable Part Numbers:
Standard packaging 1000’ Spool

Jacket Color	CMP (Plenum)	CMR (Non-Plenum)
Blue	7131849	7133849
White	7131850	7133850
Yellow	7131852	7133852
Gray	7131851	7133851
Red	7131854	7133854
Orange	7131856	7133856
Green	7131853	7133853
Black	7131858	7133858
Pink	7131857	7133857
Purple	7131855	7133855

4.1.1 Quality Control

Every Master Reel shall be tested for Attenuation, NEXT, Power Sum Crosstalk, Impedance, and RL. This testing shall be performed using a sweep test method and include frequencies from 0.772 MHz to 650 MHz.

4.1.2 Cable Packaging

The cable shall be packaged in 1000 ft (305 meter) reels with descending length designation markings.

4.1.3 Additional Specifications

Specification	Value
Flame Rating	Riser – NEC type CMR (UL) and FT4 rated Plenum – NEC type CMP (UL) and FT4 rated
Installation Tension	25 lbs. (110N) maximum
Temperature Rating	32° to 140°F (0° to 60°C) during installation 14° to 167°F (-10° to 75°C) during operation
Mechanical Test	Requirement
Ultimate Breaking Strength	> 400 N (90 lb. ft.)
Minimum Bed Radius	25.4 mm (1.0 inch)
Electrical Test	Requirement

DC resistance	<90.38 Ohm per 100M (328 ft.)
DC Resistance Unbalance	<5% at 20°C per ASTM D 4566
Mutual Capacitance	<5.6 nF per 100M (328 ft.) at 1KHz and 20°C per ASTM D 4566
Characteristic Impedance	<5.6 nF per 100M (328 ft.) at 1 kHz and 20°C per ASTM D 4566
Propagation Velocity	>62.1 (at 250 MHz) CMR: 70% CMP: 72%

4.1.4 Fiber Optic Cable:

General Cable Fiber Optic Cable Requirements:

Part Number	Description
BE0241PNU	General Cable 24 Stand 10Gig, OM3, M/M, 50um, tight buffer, Plenum

FAP Panels & Enclosures (Fiber Adapter Panel)

FAP Panels consist of 8 LC connectors and will mount is a standard Panduit MiniCom compatible Patch Panel.

Part Number	Description
FAP8WAQDLCZ	LC 10Gig™ OM3/OM4 FAP loaded with 8 LC 10Gig™ Duplex Multimode Fiber Optic Adapters (Aqua) with zirconia ceramic split sleeves
FAPB	Patch Panel Blank
FMT1	Fiber Enclosure Holds up to 4 FAPs
CFAPPBL1	FAP Adapter for up to 4 FAPs
FMT2	Fiber Enclosure Holds up to 8 FAPs
CFAPPBL2	FAP Adapter for up to 8 FAPs

Fiber optic cables shall be terminated in rack or wall mounted Fiber Optic Termination Boxes, (FOTB), of sufficient size to permit termination of all fiber strands. In the event that an enclosure must be oversized (number of termination ports) due to manufacturer's product standardization, the next larger available enclosure size shall be specified. Only one Fiber Optic Termination Box in each termination location is desired.

Adapter plates, which accommodate LC type connectors, shall be specified for all available spaces within each Fiber Optic Termination Box. Multimode Receptacle Couplers shall be included in all ports of each adapter plate. All couplers shall be treaded.

All glass strands of each strands of each fiber optic cable shall be terminated on Panduit FAPs. The connectors have the following characteristics: Multimode, FDDI compliant; LC style 2.5mm bayonet connector; Zirconium oxide (ceramic) ferrule; Low loss - 0.6 db (typical); Long strain relief boot.

All fiber optic terminations shall be fusion spliced to the individual termination (fap) in the enclosure unless otherwise specified.

Fiber Optic Patch Cords:

The modular connectors and patch cords will be chosen to match the horizontal cabling medium and rating. The same manufacturer shall provide the modular connectors and patch cords. The total patch cord length at the work area is not to exceed 3 meters (10 ft). Exception: When implementing an open office cabling system as specified under ANSI/TIA 568 C.1 (see section 3.4).

Fiber Optics

Optical Fiber Cable: **General Cable P/N: BE0241PNU**

24 Stand 10Gig – 50/125um (OM3) multimode plenum rated, tight buffer distribution cable

- Efficient packaging of higher fiber counts
- Lightweight and easy to handle during installation
- Cable design and flexible buffer tubes allow for quick breakout and ease of routing
- High quality buffering offers ease of stripping while maintaining optical performance
- Sheath markings provide positive identification and length verification
- Extends life cycle and reduces cost of ownership
- Low attenuation designs increase network reliability and performance
- Multimode/singlemode hybrid designs extend life cycle and reduce cost of ownership
- Indoor/outdoor designs meet specific application requirements
- Higher fiber count cable provides application flexibility

The *PANDUIT MINI-COM[®] Network Cabling System* shall be used for the Work Area subsystem, including all modular connectors. The network cabling system shall be comprised of *PANDUIT* Fiber Optic modular work area adapters in support of high-speed networks and applications designed for implementation on multimode (50/125 μm and 9μm) glass fiber cabling. All outlets shall utilize interchangeable and individual connector modules that mount side by side to facilitate quick and easy moves, adds, and changes. Approved components of the Fiber Termination Hardware for the Work Area Subsystem shall include but are not limited to:

- LC Style Connectors

Panduit LC Optical Fiber Patch Cords shall be constructed from high performance 50/125μm multimode cable and **LC** duplex connectors with ceramic ferrules. Integral boots shall be provided to provide strain relief and help maintain consistent polarity. They shall come in standard lengths.

Fiber Patch Cords/pigtails

Part Number	Description
FXE10-10M1Y	1-Meter Multi-mode OM3 10Gig Duplex LC

5. Telecommunications Room (IDF/MDF)

The telecommunications room (TR) includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

5.1. Cable Termination Hardware

Each horizontal or backbone cabling run will be terminated using appropriate connectors or connecting blocks depending upon the cable type. Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware.

5.1.1. Category 6A Unshielded Twisted Pair UTP

Four-pair Category 6A cabling shall be terminated onto modular patch panels, punchdown style patch panels or punchdown style connecting blocks.

5.1.1.0. Modular Patch Panels and Cords

TX6A™ 10Gig™ 4-pair Category 6A UTP cabling shall be terminated onto Category 6A Jack Modules. The eight position module shall exceed the connector requirements of the TIA/EIA Category 6A standard. The module termination to 4-pair, 100 ohm solid unshielded twisted pair cable shall be accomplished by use of a forward motion termination cap and shall not require the use of a punchdown or insertion tool.

MINI-COM® Modular Patch Panels shall be of a metal design with snap in four position molded faceplate frames. The faceplate frames shall be releasable from the front to provide access to the modules and terminated cable. Modules shall be mounted to the patch panel using MINI-COM® mounting features for added strength. Patch panels shall be available with and without labels.

Part number	Number of Ports	Rack spaces
CPP24WBLY	24	1
CPPL24WBLY	24	1
CPPA24FMWBLY	24	1
CPP48WBLY	48	2
CPPL48WBLY	48	2
CPPA48FMWBLY	48	2
CPPL72WBLY	72	3
CPPA72FMWBLY	72	3

[TX6A™ 10Gig™ Category 6A UTP Patch Cords](#) shall be used between modular patch panels configured as a cross-connect or between the patch panel and networking hardware when the patch is used as an interconnect. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6A 24-AWG solid UTP

cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the Category 6A standard.

Part number	Length (ft) ⁺	Length (M)
UTP6A3**	3	0.91
UTP6A5**	5	1.52
UTP6A7**	7	2.13
UTP6A9**	9	2.74
UTP6A14**	14	4.27
UTP6A20**	20	6.10

⁺ - Patch cords shall come in standard lengths of 3 to 20 feet (one foot increments) and 25 to 50 feet (5 foot increments).

** - Available in eight standard colors of Blue (BU), White (WH), Yellow (YL), Green (GR), Black (BL), Red (RD), Violet (VL) or Orange (OR).

5.1.1.1. Punchdown Patch Panels and Patch Cords

[DP6A™ 10Gig™ Patch Panels](#) - Category 6A UTP cabling of AWG 22 – 26 shall be terminated onto four-pair punchdown style connecting hardware mounted to the rear of integral patch panels and routed to Category 6A modules on the front face of the patch panel. Patch panels shall be universal for T568A and T568B wiring configurations. The patch panels shall have a removable 6 port design that allows 6 ports to be removed from the rear of the panel without disrupting the other ports. Integral cable tie mounts shall be included in the panel for cable management on the back of the panel. Port and panels shall be easy to identify with write-on areas and optional label holder for color-coded labels. Patch panels are available in flat style and angled style. Rack mountable patch panels shall mount to standard EIA 19" and 23" racks

Part number	Number of Ports	Style	Wiring Configuration	Rack spaces
DP246X88TGY	24	Flat	Universal	1
DP486X88TGY	48	Flat	Universal	2
DPA246X88TGY	24	Angled	Universal	1
DPA486X88TGY	48	Angled	Universal	2

[TX6A™ 10Gig™ Category 6A UTP Patch Cords](#) shall be used between modular patch panels configured as a cross-connect or between the patch panel and networking hardware when the patch is used as an interconnect. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6A 24-AWG solid UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the Category 6A standard.

Part number	Length (ft) ⁺	Length (M)
UTP6A3**	3	0.91
UTP6A5**	5	1.52
UTP6A7**	7	2.13
UTP6A9**	9	2.74
UTP6A14**	14	4.27

UTP6A20**	20	6.10
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+ - Patch cords shall come in standard lengths of 3 to 20 feet (one foot increments) and 25 to 50 feet (5 foot increments).

** - Available in eight standard colors of Blue (BU), White (WH), Yellow (YL), Green (GR), Black (BL), Red (RD), Violet (VL) or Orange (OR).

5.1.1.2. Punchdown System and Patch Cord Assemblies

Category 6A UTP cable shall be terminated on *GP6™ PLUS* standard density punchdown style Category 6 connecting base, providing for the termination of 6 four pair cables per horizontal row. The connecting base shall employ deep channels to provide additional space for cable management. The connecting block shall have a compatible footprint with installed 110 systems, use optimum positioning of contacts to improve wire insertions and shorten the distance from cable jacket end to point of wire termination. The connecting block shall have rounded edges. The wire strip and connecting block, shall be marked with a highly visible color code, and allow for the termination of one full pair, or four full pairs at a time.

Part number	Description	Count	Mounting
GPB24-X	Standard Density Base	24-port	Rack/Frame
GPB72-X	Standard Density Base	72-port	Rack/Frame
GPBW24-X	Standard Density Base	24-port	With Legs
GPBW72-X	Standard Density Base	72-port	With Legs

6. Racks & Enclosures

Panduit 4 post EIA rack shall be specified as indicated in the table below:

Part number	Description	QTY
R4P96/R4PCN96	8 foot x 30" deep 4 post rack Non and Cage Nut version	TBD
R4P3696/R4P36CN96	8 foot x 36" deep 4 post rack Non and Cage Nut version	TBD
R4P4296/R4P42CN96	8 foot x 42" deep 4 post rack Non and Cage Nut version	TBD
RSHELF	19"W x 30"D	TBD
RSHELF23	19"W x 23"D	TBD
RSHELF36	19"W x 36"D	TBD

Wall Mount Cabinets and Wall Mount Open Frame Racks

Part number	Description	Color
Hoffman AccessPlus II -EWMW362825	36" Window door with cable manager	Black
Hoffman AccessPlus II -EWMW482825	48" Window door with cable manager	Black
Hoffman Open Frame Rack – E19SWM20U20	40" Open Frame Wall Mount Rack	Black
Hoffman Open Frame Rack – E19SWM25U20	48" Open Frame Wall Mount Rack	Black

Hoffman 24" Ladder Rack & Accessories

Part number	Description	Color
LSS24BLK	Ladder Rack Straight Sections	Black
LIB24BLK	Ladder Rack Inside Curved Sections	Black
LOB24BLK	Ladder Rack Outside Curved Sections	Black
L90HB24BLK	90-Degree Horizontal E-Bend Section	Black
LBSKB	Butt-Splice Kit	Black
LABSKB	Adjustable Butt-Splice Kit	Black
LJSKB	Junction Splice Kit	Black
LFKB	Foot Kit	Black
LRRMPBLK24	Rack-to-Runway Mounting Plate Kit	Black
LVWBB	Vertical Wall Bracket	Black
LTSB24BLK	Triangle Support Bracket Kit	Black
LWASK24BLK	Wall Angle Support	Black
LEC	End Cap Kit	Black
DGJ	Insulated Ground Jumper Kit	N/A
LRWSBKB	Ceiling Support Kit	Black

SWITCHING AND PATCHING CABINETS

The Switching and Patching Cabinet shall be used to provide a neat and efficient means for routing and protecting cables and patch cords in cabinets for network switching and patching applications. The cabinet shall provide vertical cable managers, have provisions for routing cables from under floor and overhead, and shall accept 19" horizontal cable managers, and cable

management accessories used throughout the cabling system. The cabinet shall protect network investment by enclosing network cabling and equipment, maintaining system performance, and controlling cable bend radius.

Switch Cabinet

Cable Management shall be provided using a cabinet that supports heavy equipment for cross connect or interconnect applications. The cabinet shall be comprised of modular cable management finger sections, completely bonded through an integral grounding system, and have a minimum of 6" of clearance between the switch inlet or exhaust and the cabinet side panels. The cabinet shall be constructed of steel material and support 19" components. The rack shall be UL listed for 2500-pound load rating to accommodate large networking equipment. The cabinet shall provide integral cable management including vertical channels, provisions for the mounting of optional slack spools, knock out holes in the top and an open frame bottom for under floor cable routing. The cabinet shall accept removable, hinged doors and latching side panels. The cabinet shall be able to accept a dual hinging door to provide complete access to the cables and equipment. Casters shall be an available option, and shall be field installable and removable without tipping the cabinet. Leveling legs shall extend through the cabinet frame for accessibility and easy adjustment without tipping the cabinet.

Part Number	Description
CN1	Cabinet frame with top panel. Includes dual hinging perforated front door, split perforated rear doors, solid side panels, two sets of #12-24 threaded equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN1CN	Cabinet frame with top panel. Includes dual hinging perforated front door, split perforated rear doors, solid side panels, two sets of cage nut equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN2	Cabinet frame with top panel. Includes dual hinging perforated front door, split perforated rear doors, two sets of #12-24 threaded equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN2CN	Cabinet frame with top panel. Includes dual hinging perforated front door, split perforated rear doors, two sets of cage nut equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN3	Cabinet frame with top panel. Includes two sets of #12-24 threaded equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN3CN	Cabinet frame with top panel. Includes two sets of cage nut equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN4	Cabinet frame with top panel. Includes split perforated front and rear doors, solid side panels, two sets of #12-24 threaded equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CN5	Cabinet frame with top panel. Includes split perforated front and rear doors, two sets of #12-24 threaded equipment mounting rails, and 45 RU of cable management on front and rear of front posts.
CNPS	Solid side panel.
CNBRFK	Set of cable management finger sections to populate 45 RU.
CNSPE	End mount slack spool.
CNSPC	Center mount slack spool for ganged cabinets.
CNCSTR	Set of 4 casters.
CNAE1	Air duct for Cisco 6509 switch.
CNAE2	Air duct for Cisco 9513 switch.
CNAE3	Air duct for Cisco 6513 switch.
CVPDUB	Vertical Power Outlet Unit mounting bracket.

Server Cabinets

The Server Cabinet shall be used to provide a neat and efficient means for routing and protecting cables, patch cords and power cables in cabinets for server applications. The cabinet shall provide provisions for mounting patch panels and Power Outlet Units (POUs) vertically without blocking the area behind the servers, vertical blanking panels on the outside of the cabinet frame to prevent cold aisle air from bypassing the servers to the hot aisle, vertical cable managers, have provisions for routing cables from under floor and overhead, and shall accept 19" horizontal cable managers, and cable management accessories used throughout the cabling system. The cabinet shall protect network investment by enclosing cabling and equipment, maintaining system performance, and controlling cable bend radius.

Cable Management shall be provided using a cabinet that supports heavy equipment for server applications. The cabinet shall be comprised of modular cable management finger sections, completely bonded through an integral grounding system, and have vertical space between the cabinet frame posts and side panels for vertical mounting of patch panels or Power Outlet Units (POUs) without blocking the area behind the servers. The cabinet shall be constructed of steel material and support 19" components. The rack shall be UL listed for 2500-pound load rating to accommodate large networking equipment. The cabinet shall provide integral cable management including vertical channels, provisions for the mounting of optional slack spools, knock out holes in the top and an open frame bottom for under floor cable routing. The cabinet shall accept removable, hinged doors and latching side panels. Casters shall be an available option, and shall be field installable and removable without tipping the cabinet. Leveling legs shall extend through the cabinet frame for accessibility and easy adjustment without tipping the cabinet.

Part Number	Description
CS1	Cabinet frame with top panel. Includes single hinging perforated front door, split perforated rear doors, solid side panels, one set of extended front cage nut equipment mounting rails, one set of rear cage nut equipment mounting rails, vertical blanking panels, one set of Power Outlet Unit (POU) brackets and 45 RU of cable management on rear of rear posts.
CS2	Cabinet frame with top panel. Includes single hinging perforated front door, split perforated rear doors, one set of extended front cage nut equipment mounting rails, one set of rear cage nut equipment mounting rails, vertical blanking panels, one set of Power Outlet Unit (POU) brackets and 45 RU of cable management on rear of rear posts.
CS3	Cabinet frame with top panel. Includes one set of extended front cage nut equipment mounting rails, one set of rear cage nut equipment mounting rails, vertical blanking panels, one set of Power Outlet Unit (POU) brackets and 45 RU of cable management on rear of rear posts.
CVPPB	Bracket to vertically mount 1 RU EIA 19" copper and fiber patch panels to the side of the cabinet posts.
CNPS	Solid side panel.
CNBRFK	Set of cable management finger sections to populate 45 RU.
CNSPE	End mount slack spool.
CNSPC	Center mount slack spool for ganged cabinets.
CNCSTR	Set of 4 casters.

7. Vertical Cable Management

Part number	Description	QTY
PRV6/PRD6	6" wide vertical manager & door	TBD
PRV8/PRD8	8" wide vertical manager & door	TBD

8. Horizontal Cable Management

Part number	Description	QTY
NM2	3.5"H x 19.0"W x 13.1"D (88mm x 482mm x 332mm). 2RU	TBD
NM3	5.2"H x 19.0"W x 13.1"D (133mm x 482mm x 332mm). 3RU	TBD
NM4	7.0"H x 19.0"W x 13.1"D (177mm x 482mm x 332mm) 4RU	TBD

9. Fiber Cable & Fiber Enclosures

Fiber between IDF and MDF facilities shall consist of 12 strands of OM3 multimode fiber. The fiber is to terminate on LC connectors (Opticam) and plug into LC opticam FAP panels to be mounted in 24 port minicam patch panels. The panels to use were indicated in section above.

Part Number	Description	Quantity
FAP6WAQDLCZ	10G FAP loaded with 6 LC connectors	TBD
FODRZ12Y	10G 50/125 micron fiber 12 strands	1000 ft min order
FLCSMCXAQY	Opticam LC Pre-Polished Cam Termination	TBD
FRME1U	Holds up to three FAP or FMP adapter panels or FOSM splice modules. Bi-directional sliding drawers provides front and rear access to fibers. Dimensions: 1.74"H x 17.00"W x 14.20"D	1 per IDF
FRME2U	Holds up to six FAP or FMP adapter panels or FOSM splice modules. Bi-directional sliding drawers provides front and rear access to fibers. Dimensions: 3.48"H x 17.00"W x 14.20"D (88.0mm x 432.0mm x 361.0mm)	TBD

FRME3	Holds up to nine FAP or FMP adapter panels. Fixed bulkhead design. Dimensions: 5.00"H x 17.16"W x 11.80"D (127.0mm x 433.3mm x 292.1mm)	TBD
FRME4	Holds up to twelve FAP or FMP adapter panels. Fixed bulkhead design. Dimensions: 6.62"H x 17.16"W x 11.80"D (168.1mm x 433.3mm x 292.1mm)	TBD

10. Fiber Patch Cords

Part Number	Description	Quantity
FXE10-10M1Y	1-Meter Multi-mode OM3 10Gig Duplex LC	TBD
FXE10-10M2Y	2-Meter Multi-mode OM3 10Gig Duplex LC	TBD
FXE10-10M3Y	3-Meter Multi-mode OM3 10Gig Duplex LC	TBD
FXE10-10M5Y	5-Meter Multi-mode OM3 10Gig Duplex LC	TBD

11. Installation Guidelines

The PanGen 6A™ 10GIG™ Copper Cabling System with Mosaic Technology ([PN390](#)) is to be installed in accordance to the cable management requirements set forth in ANSI/TIA/EIA-568-B (*Commercial Building Telecommunications Cabling Standard*) and in ANSI/TIA/EIA-569-B (*Commercial Building Standard for Telecommunications Pathways and Spaces*).

6.1 Pathways and Spacing Management

6.1.1 Fill Capacity

- Pathways should be located to minimize occupant disruption and allow for easy moves, adds and changes.
- For initial installation, the maximum fill capacity for pathways (i.e. conduit, raceways, trays, baskets) is 40 percent.

$$\text{Number cables} = \text{Pathway Internal Area} / \text{Cable Area} \times 40\%$$

For the PanGen 6A™ 10GIG™ plenum (7131849 / Blue) and riser (7133849 / Blue) cables, the cable area is 0.0754 inches² (49 mm²).

The maximum fill capacity of 60 percent is allowed to accommodate future additions after initial installation.

6.1.2 Bend Radius

- Proper cable bend radius control must be maintained throughout the pathways. The bend radius needs to be four (4) times the cable diameter.

- For the PanGen 6A™ 10Gig™ plenum (7131849 / Blue) and riser (7133849 / Blue) cables, the minimum bend radius is 1.24 inches (31 mm).

6.1.3. Pathways

- For data center applications, it is recommended to use Panduit® FIBERRUNNER™ Routing Systems for cable raceway management. The fittings provide minimum 2-inch bend radius to protect against signal loss due to excessive cable bends.
- Pathways should be designed to allow for future expansion (minimum two cables per work area, with pathways supporting three cables per work area). Therefore when designing a pathway, the pathway needs to accommodate 150% of the initial cable installation. For example, if the initial design requires 2 cables each for ten work areas, the pathway shall be designed to accommodate 30 cables.
- Conduit should be run in the most direct route possible with no more than two 90 degree bends between pull boxes and serve no more than three outlet boxes. Conduit bends should be at least six times the conduit diameter.
- Cable trays are to be installed per manufacturing guidelines and loading capacities must be considered during cabling installation.
- Cable trays used in the ceiling should allow for at least 12 inches (305 mm) of clearance above the tray. Cable trays used in the floor should allow for at least 2 inches (51 mm) of clearance between the top part of the tray and the bottom of the floor tile.
- JHooks should be located at 4 to 5 feet intervals and have at least 3 inches (76 mm) of clearance above suspended ceilings.
- Due to the crush weight on the bottom most cables, it is recommended that no more than 25 PanGen 6A™ 10Gig™ Copper Cables with Mosaic Technology be placed in a single tier of a Panduit® JMOD® Cabling Support System.
- Maintain proper distance between hangers to avoid cable stress caused by tension in the suspended run.

6.1.4 Cable Separation Management

- Separation and physical barriers between PanGen 6A™ 10Gig™ copper cable and power cables must be maintained within raceways. Refer to NEC code for minimum distance requirements

6.2 Cable Pulling & Installation Management

- The maximum channel distance for the PanGen 6A™ 10Gig™ Copper Cabling System with MaTriX Technology in the backbone and/or horizontal is 328 feet (100 meters). The total length of equipment cords, patch cords and work area cords shall not exceed 33 feet (10 meters).
- The maximum permanent link distance for the PanGen 6A™ 10Gig™ Copper Cabling System with Mosaic Technology in the backbone and/or horizontal is 295 feet (90 meters).
- The maximum pulling tension is not to exceed 25 lb-ft. Cable installation should not in any way deform the cable jacket.
- The recommended installation temperature range is 320 – 1400 F (00 – 600 C).
- Avoid pathways exposed to extreme thermal cycling.
- The cable should not come in contact with any water or chemicals, or be exposed to any high humidity during or after installation.
- Avoid any cable kinks and maintain proper bend radius control during cabling pulling. If any kinks should occur, kinked cable should be removed and replaced.

- Tak-Ty® Hook & Loop Cable Ties, Contour-Ty® Cable Ties, Belt-Ty™ In-Line Cable Ties or Pan-Ty® Cable Ties should be applied loosely and at random intervals to cable bundles to avoid any pinching or crushing of the cable jackets.

6.3. Cable Management in the Telecommunication Room

- Organize and manage cables for quick and easy moves, adds and changes.
- Termination procedures at the patch panel include:
 - Feed cables from both sides of the panel
 - Maintain acceptable bend radius levels
 - Do not kink cables
 - Do not cinch cable ties so tightly as to deform the cable in any way
 - To enhance wire management in the back of the panel, it is recommended that a strain relief bar (part number [SRBM19BLY](#)) be mounted to the rack. The strain relief bar includes Tak-Ty® Hook & Loop Cable Ties for additional cable management.
- Termination procedures for the DP6™ 10Gig™ modular punchdown patch panel include:
 - Following installation instruction sheet [PN379E](#)
 - Outer cable jacket should be as close as possible to point of termination
 - Last twist should be no further than 0.5 inches from the point of termination.

6.4. Cable Management in the Work Area

- For surface raceway applications, the Panduit TG Raceway system is the optimal solution in the work area for routing PanGen 6A™ 10Gig™ Copper Cables with MosaicTechnology.
- The TG Raceway system provides adequate space to maintain proper cable bend radius control.
- Allow for at least one outlet per work area with a minimum of two cable terminations.
- Pathways should be designed to allow for future expansion. For example, work areas with two cables must be served by pathways that can accommodate a minimum of three cables.
- Allow for at least 12 inches (305 mm) of slack at the work area. Pull slack up into the ceiling or back into the raceway and store it there, where it can later be pulled into the box if re-termination is necessary.
- Terminate PanGen 6A™ 10Gig™ Jack Modules with Mosaic Technology per installation instruction sheet [PN511A](#).
- To improve bend radius control of PanGen 6A™ 10Gig™ Copper Cable in junction boxes, it is recommended that Panduit sloped faceplates (i.e. P/N [UICFPSE2**](#)) be used in the work area.
- With Panduit sloped faceplates, the following junction boxes can be used with *PanGen 6A™ 10GIG™* copper cable: [JBX3510**-A](#), [JB1**-A](#), [JBP1**-A](#), [JBP11**](#), [JB1FS**-A](#), [JBP2**](#), [JBPFS](#), [JB1D**-A](#), [JBP1D**](#), [JBP2D**](#).
- With Panduit flush faceplates, the following junction boxes can be used with PanGen 6A™ 10Gig™ Copper Cable: [JBP1D**](#), [JBP1D**](#), [JBP2D**](#).

1.2 Testing and Acceptance

General

All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA 1152 AND ANSI/TIA-568 C.2. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system 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 in all cables installed.

All cables shall be tested in accordance with this document, the ANSI/TIA standards, the PANDUIT® **CERTIFICATION PLUS**SM System Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

Copper Channel Testing

All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA 1152 and ANSI/TIA 568-C.2 11 for the appropriate Category of cabling installed.

All wireharness cabling shall be tested with a Fluke Link-Runner test meter. Testing for basic network connectivity is required. Reports to be generated and delivered to Madera County Office of Education.

Fiber Testing

All installed fiber shall be tested in accordance with ANSI/TIA-C.0 AND ANSI/TIA-3.3

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.

Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in both directions.

Single mode testing shall incorporate the same testing methods as Multimode for the proper spectrum.

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

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 PERMENT LINK LOSS TEST 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. The values for calculating loss shall be those defined in the ANSI/TIA 568-C.3 Standard.

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.

System Documentation

Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer/End User for approval. Documentation shall include the items detailed in the sub-sections below.

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. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

The Engineer 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 the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Madera County Office of Education.

Customer request channel warranties on all connections through Panduit.

Test Results

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). 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). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. 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.

The field test equipment shall meet the requirements of ANSI/TIA-568-C series of Standards. The appropriate and most current level tester shall be used to verify Category 6A cabling systems.

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. 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.

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.

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. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. Madera County Office of Education will provide floor plans in paper and electronic (Visio) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to Madera County Office of Education.

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

Grounding and Bonding

This section is for contractor reference and can be used for this and future installations.

See Appendix A for the method to ground the Cisco Hardware.

A Telecommunications Main Grounding Busbar (TMGB) shall be located at the service entrance. A Telecommunications Grounding Busbar (TGB) shall be located in each telecommunications space. The TGB will be grounded/earthed to the Telecommunications Main Grounding Busbar (TMGB).

The TMGB shall be bonded to building steel and grounded/earthed to the electrical service ground according to J-STD-607-A guidelines. Each TGB shall be bonded to building steel and the electrical panel serving equipment in the telecommunications space.

The gauge of the connecting ground/earth cable, known as the Telecommunications Bonding Backbone (TBB) will follow J-STD-607-A guidelines, as is shown in the table below.

Sizing of the TBB	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
Greater than 20 (66)	3/0

Route the TBB to each TGB in as straight a path as possible. The TBB should be installed as a continuous conductor, avoiding splices where possible. Use *PANDUIT* part number series HTWC to tap into the TBB where necessary. When more than one TBB is used, bond them together using the TGBs on the top floor and every third floor in between with a conductor known as a grounding equalizer (GE). Use the J-STD-607-A guidelines for sizing of the TBB when sizing the GE (shown in the table above).

1.3 Components, Kits and Hardware

1.4

PANDUIT® STRUCTUREDGROUND™ Grounding System (*STRUCTUREDEARTH™* Earthing System) kits, components, and hardware shall be used to construct the grounding/earthing system.

Use *PANDUIT* GB4 series BICSI/J-STD-607-A telecommunications grounding busbars for the TMGB, which is ideally located at the AC service entrance. Use a *PANDUIT* GB2 series busbar for the TGB in each of the other telecommunications/equipment spaces throughout the building. Use *PANDUIT* LCC-W series lugs when connecting conductors to the TMGB and TGB.

1.5 Construction of the Grounding/Earthing System

1.6 Avoid routing grounding/earthing conductors in metal conduits. If the grounding/earthing conductor must be routed through a metal conduit, bond each end of the conduit to the grounding/earthing conductor. Use *PANDUIT* GPL series grounding clamps to bond to the conduit, a *PANDUIT* HTWC HTAP with clear cover to bond to the grounding/earthing conductor, and a #6 AWG copper conductor to connect the GPL grounding clamp to the HTWC HTAP.

1.7

1.8 In telecommunications spaces with a small number of racks or cabinets, it may be most convenient to bond the grounding/earthing jumper cable directly to the TGB. Larger spaces require a mesh Common Bonding Network, as described below.

1.9

Cable Sizes for Other Grounding/Earthing Applications Not Specifically Described Elsewhere in This Document	
Purpose	Copper Code Cable Size
Aisle grounds (overhead or under floor) of the common bonding network	#2 AWG
Bonding conductor to each PDU or panel board serving the room.	Size per NEC 250.122 & manufacturer recommendations
Bonding conductor to HVAC equipment	#6 AWG
Building columns	#4 AWG
Cable ladders and trays	#6 AWG
Conduit, water pipe, duct	#6 AWG

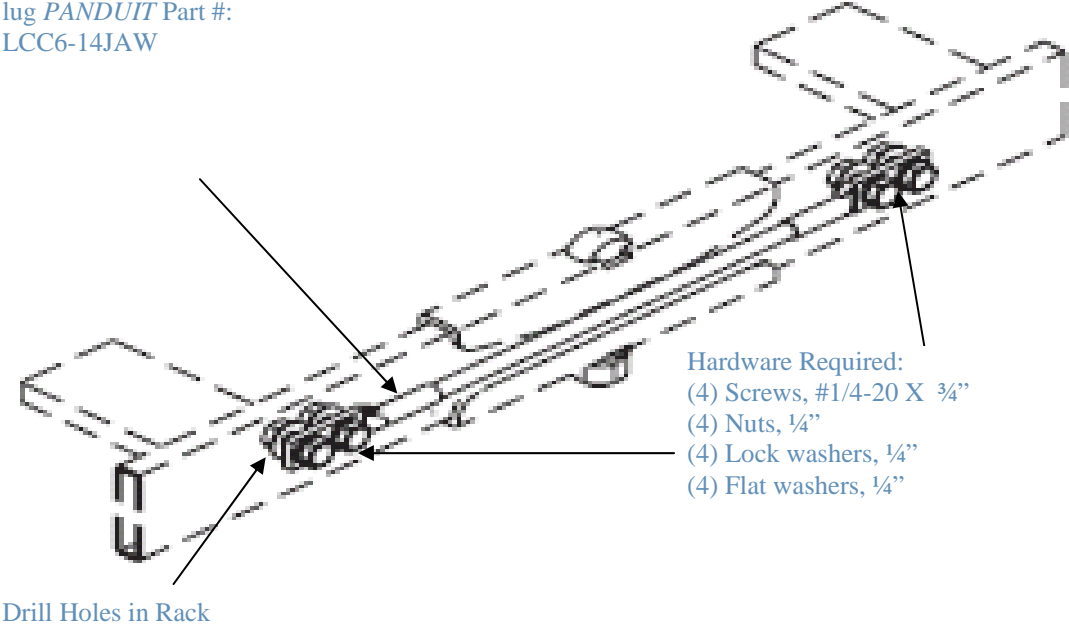
Ladder Rack Bonding

Ladder racks shall be bonded per the manufacturer’s installation instructions. The bond shall be made in accordance with Figure 3 below to the mesh Common Bonding Network.

Figure 3 – Ladder Rack Bonding

To provide electrical continuity between ladder rack segments drill holes in rack and use a #6 AWG code cable with green/yellow stripe to jumper between segments. The jumper shall be made with 2-hole copper compression connectors, *PANDUIT* part series LCC-W, terminated on both ends. Attach jumper to ladder rack with hardware listed in figure 3 above. Once the ladder rack segments are bonded together, it shall be bonded to the TGB with *PANDUIT* part series LCC-W.

6 AWG, 2-hole compression
lug *PANDUIT* Part #:
LCC6-14JAW



Rack Grounding/Earthing

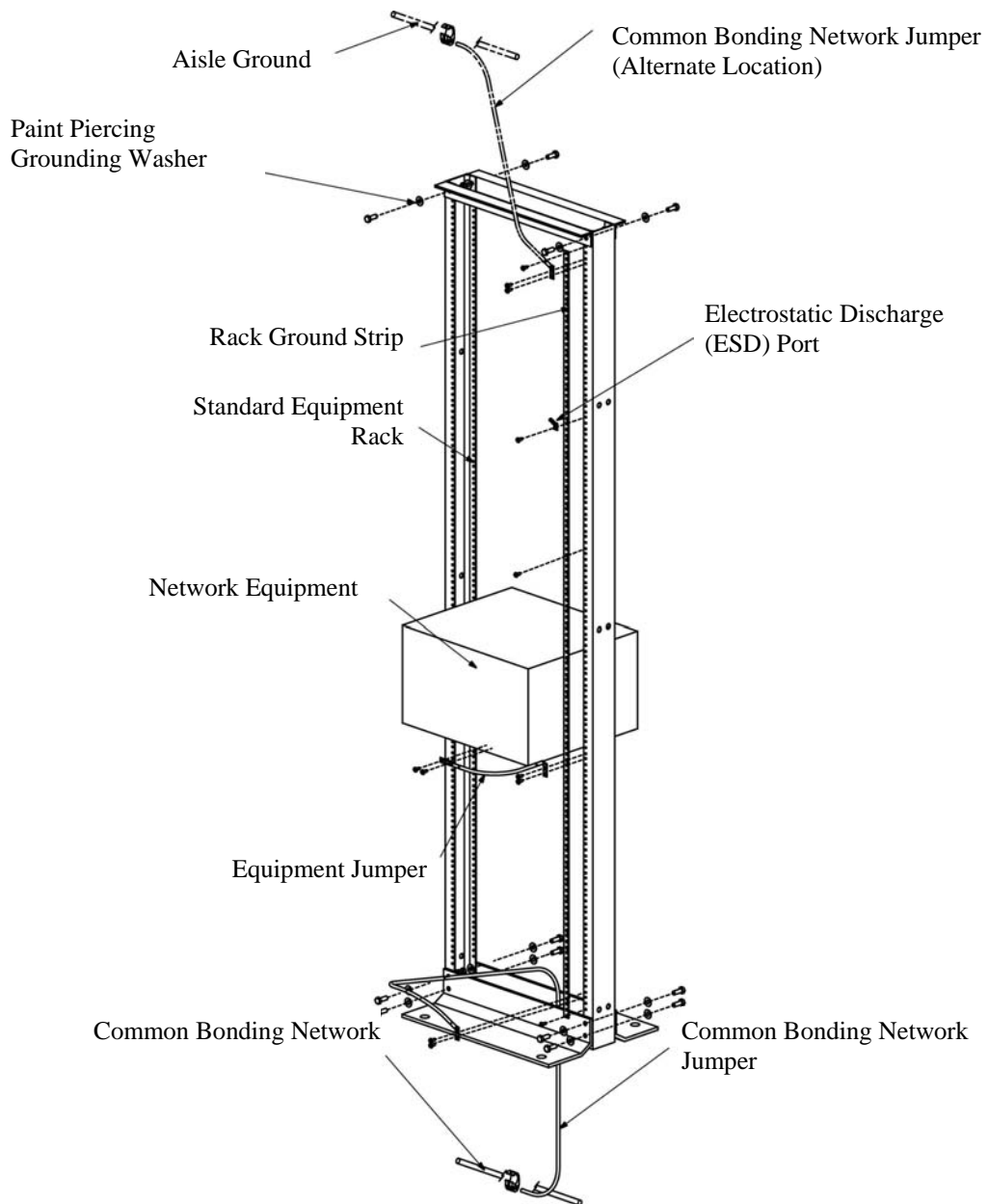


Figure 4 - Properly Grounded/Earthed Rack (Back of Rack Shown)

To provide electrical continuity between rack elements, *PANDUIT* paint piercing grounding washers, series RGW, shall be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.

All racks shall utilize a full-length rack ground strip, *PANDUIT* series RGS, attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact.

Mount an electrostatic discharge (ESD) port kit, *PANDUIT* series RGESD, directly to the rack grounding strip on the back of the rack at approximately

48 inches from the floor. Mount a second RGEDS directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack. Place the ESD protection identification stickers directly above the ESD ports.

When the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. Use the appropriate *PANDUIT* RG series jumper for the equipment being installed and the thread-forming screws provided in the kit.

Use *PANDUIT* part number series RGCBNJ (Common Bonding Network Jumper) to attach the rack ground strip to the mesh CBN. This kit includes the #6 AWG cable with one factory installed two-hole lug and hardware to connect to the busbar and one HTAP to connect to the mesh CBN. In addition, all components can be utilized if your mesh common bonding network is below or overhead. Do not bond racks or cabinets serially. Use the copper compression HTAP that comes with the kit to bond the conductor directly to the mesh common bonding network.

Patch panels will be bonded to racks using the *PANDUIT* bonding screws, part number RGTBSG-C for racks having #12-24 equipment mounting holes, and RGTBSM6G-C for racks having M6 equipment mounting holes.

Retrofit Rack Grounding/Earthing

If the racks already have network equipment installed, it may not be feasible to install the rack ground strip without disrupting data cables. Further, it may be undesirable to disassemble rack hardware to install paint piercing grounding washers, or in some cases, the construction of the rack may make grounding washer installation impossible. In these circumstances, the *PANDUIT* Retrofit Rack Grounding Kits, *PANDUIT* part family RGR, are to be installed.

For retrofit rack grounding/earthing installations, use *PANDUIT* part number RGRKCBNJY to ground/earth the rack to the mesh common bonding network. Use *PANDUIT* part number RGREJ696Y (provided with #6 AWG grounding conductor) or *PANDUIT* part number RGREJ1096Y (provided with #10 AWG grounding conductor) to ground/earth equipment chassis to the rack grounding busbar provided with the RGRKCBNJY as is shown in figure 6 below.

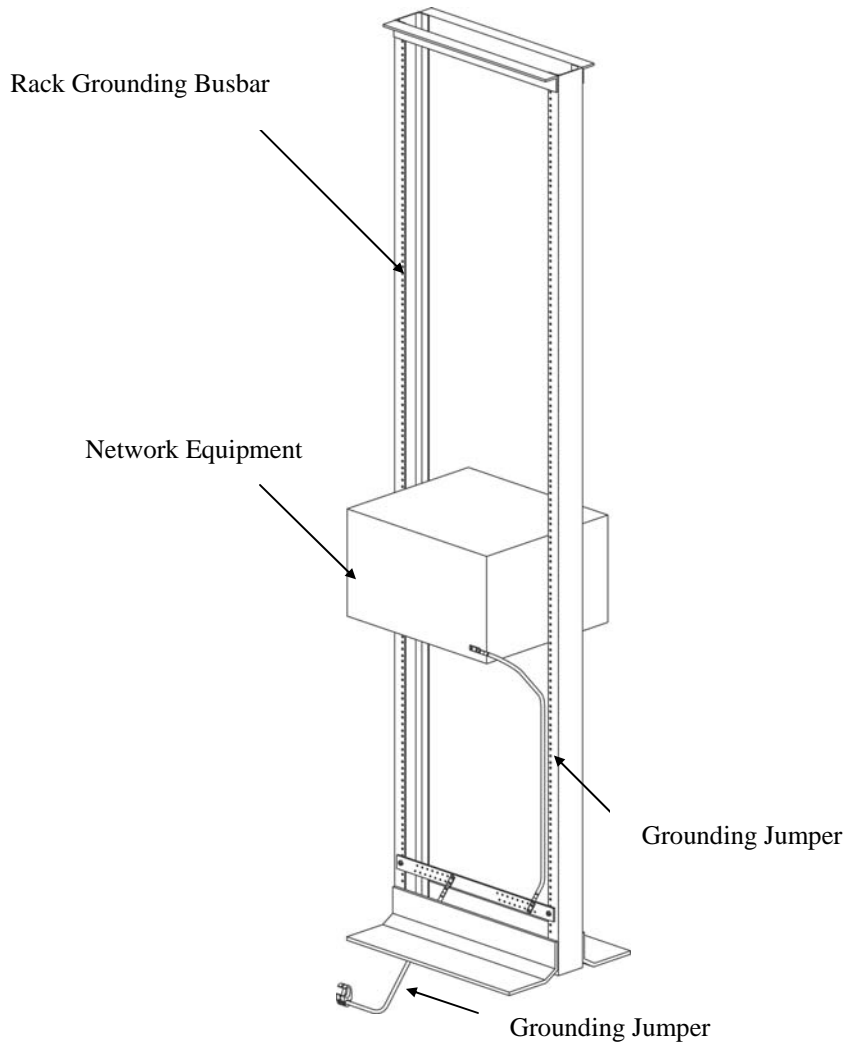


Figure 6 - Retrofit Rack Grounding/Earthing

To provide electrical continuity between cabinet rails, *PANDUIT* rail jumper kit, series CGJ, shall be used to bond the front and rear equipment mounting rails. It may not be feasible or may be undesirable to disassemble the cabinet to install the paint piercing washers. Using the rail jumper kits is a more cost effective way to bond the equipment mounting rails together.

All cabinets shall utilize a full-length rack ground strip, *PANDUIT* series RGS, attached to the four mounting rails using the thread-forming screws provided to ensure metal-to-metal contact.

All cabinets shall utilize a copper busbar, *PANDUIT* part number RGRB19U, as a main collection point before connecting to the common bonding network (CBN). The busbar can be mounted at the top or the bottom of the cabinet depending on where the CBN is located.

The copper busbar will then be connected to the CBN utilizing the *PANDUIT* common bonding network jumper kit, part number series RGCBNJ. This kit includes the #6 AWG cable with one factory installed two-hole lug and hardware to connect to the busbar and one HTAP to connect to the CBN. In addition, all components can be utilized if the CBN is below or overhead.

Mount an electrostatic discharge (ESD) port kit, *PANDUIT* series RGEDS, directly to the grounding strip on the back of the cabinet at approximately 48 inches from the floor. Mount a second RGEDS directly to the grounding strip at the front at approximately the same height. Place the ESD protection identification stickers directly above the ESD ports.

Cabinet equipment mounting rails may utilize cage nuts, threaded holes or thru-hole type mounting fasteners to secure equipment to the rails. Each kit is supplied with the unique thread-forming screws and bonding studs to provide the bond to the equipment mounting rails.

Grounding/Earthing *PANDUIT* Cabinets

All *PANDUIT*® *NET-ACCESS*™ Cabinets shall be bonded in accordance with the methods prescribed in ANSI/TIA-942, as shown in figure 7 below.

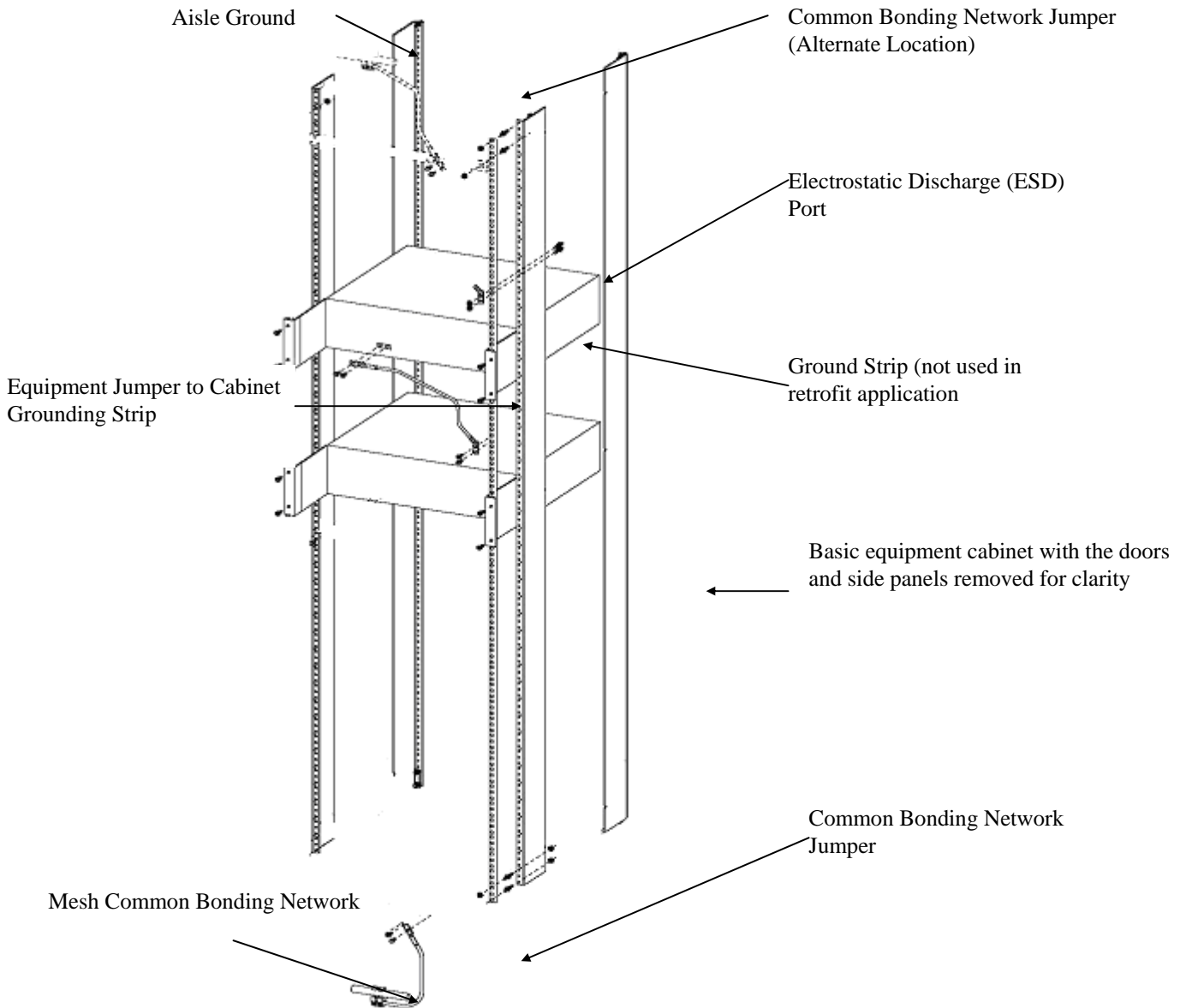


Figure 7 - Properly Grounded/Earthed PANDUIT Net Access Cabinet (Back of Cabinet Shown)

Retrofit Cabinet Grounding/Earthing

If the cabinets already have network equipment installed, it may not be feasible to install the rack ground strips without disrupting data cables. In these cases the rack ground strip would not be used and equipment jumpers would be used to make the bond between network equipment and the busbar. See Figure 6 for details.

All other grounding/earthing requirements apply to retrofit installations without exception.

Shield Grounding

A key element of a shielded copper cabling system is proper grounding. *PANDUIT TX6™ 10GIG™* Shielded Copper Cabling System shall be bonded as shown in figure 8 below.

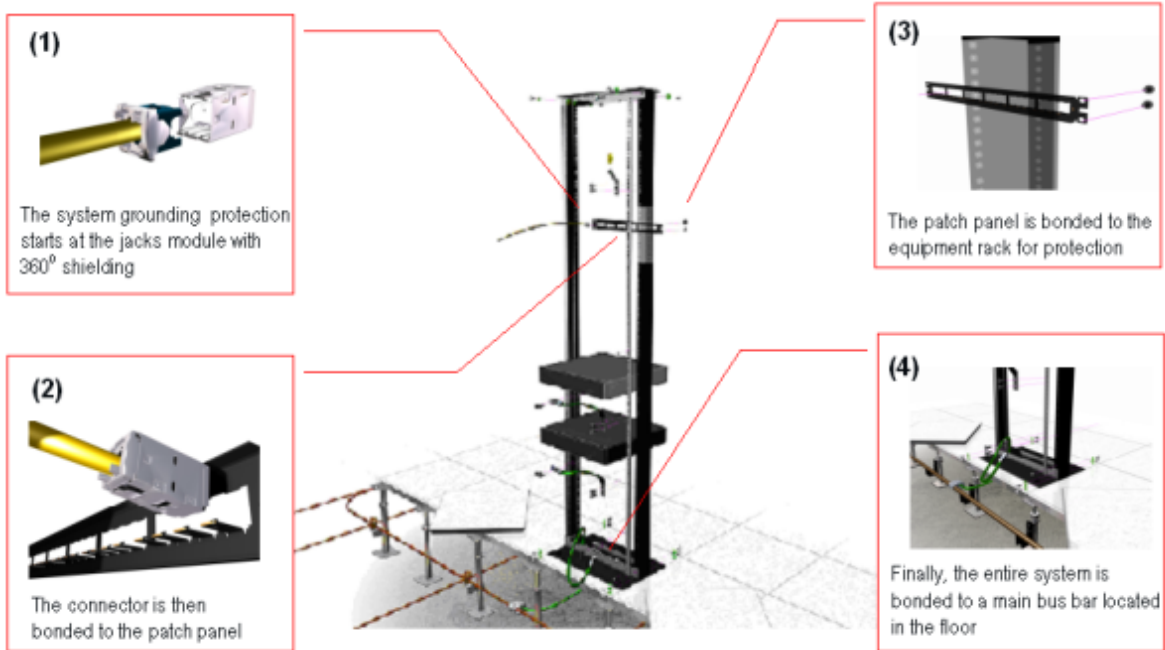


Figure 8 – Properly grounding shielded copper cabling system

The cable shield shall be run continuously from port-to-port. As the shield becomes bonded to the equipment chassis when the plug is inserted into the jack on the equipment, this effectively bonds the shield conductor at both ends of the cable, and at patch panels in between. Such a system is most effective at reducing noise coupling to the data signal so long as the power sources feeding the equipment involved are bonded together.

Labeling

This section is inserted for your reference. Please follow the Madera County Office of Education cable labeling schema.

Technical Reference Design

ID Products

The Need for Labeling

Proper labeling is crucial to the successful management of data center infrastructure. Labeling in the data center provides two very important benefits - *determining* locations of components and *defining* the system connections. It is this *determining* and *defining* that allows quick, clear communication required to accurately install, maintain, and repair critical infrastructure components resulting in efficient and reliable data center performance.

Grid Labeling

Component locations are determined using a X-Y coordinate system that is usually based on the floor tile system in the data center space. Using alphabetic designations on one axis of the room and numerical designations on the other axis of the room create a series of alphanumeric designations that can be established for each floor tile in a data center space.

These floor tile designations are the basis for determining the location of data center devices.

	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT
01																				
02																				
03																				
04																				
05																				
06																				
07																				

Grid Label Recommendation

Printer Type Laser/Inkjet
Label P/N C850X1100YJJ

Cabinet/Rack Labeling

The floor tile designations are used to identify each cabinet or rack in the data center. The cabinet/rack location is based on which floor tile the right front corner of the cabinet/rack rests upon. Cabinets and racks should have location labels applied to the top and bottom of both the front and rear of the device. These labels should be visible whether or not doors are closed or opened on the cabinets.



A typical cabinet/rack label would have the following scheme:

AB04

THIS IDENTIFIER WOULD DEFINE THAT THE CABINET/RACK IS LOCATED WITH ITS RIGHT FRONT CORNER AT THE INTERSECTION OF ROW AB AND COLUMN 04.

Cable/Rack Label Recommendation

Printer Type	Laser/Inkjet	LS8	Desktop Thermal
Label Area	2.00 x 1.00	2.00 x 1.00	2.00 x 1.00
Label P/N	C200X100YJJ	C200X100YPC	C200X100YPT

Panel Labeling

Once the cabinet/rack identifiers are established then the various panels in the cabinet/rack should be identified. The designation for the panel positions in a cabinet/rack can be either an alphabetic designation or a two-digit number that represent the rack unit number (RU) where the top-left mounting screw lands in the cabinet/rack. Using the RU method provides the data center manager with greater flexibility since it allows for panels and equipment to be added or removed later and not disrupt the designation of panel identifiers.



A typical panel label would have the following scheme:

AB04-24

This identifier would define that the top left mounting screw of the panel is located at the 24th rack unit position in the cabinet/rack located grid AB04 in the data center.

Panel Label Recommendation

Printer Type	Laser/Inkjet	LS8	Desktop Thermal
Label P/N	C100X050YJJ	C100X050YJC	C100X050YJT

Port Labeling

Now that cabinets/racks and panels in each rack are identified the next task is to establish identifiers for each port on a panel. Port identifiers are very important in that they will define the connectivity of cabling within the data center infrastructure. Many patch panels come from the factory with numbers already screen-printed above the ports. If this is the case then there is no need to re-label those patch panels. If the patch panels are not pre-printed with port numbers then labels will need to be created to identify the port numbers. The numbering sequence should proceed from left to right and top to bottom for all ports on a patch panel. The number of digits used for all numbers on a patch panel should be consistent with the total number of ports on that patch panel. For example a 48-port patch panel should be labeled 01 through 48 and a 144-port patch panel should be labeled 001 through 144.



A typical port label would have the following scheme:

AB04-24:01

This identifier can be decoded to define that this is port 01 located on panel 24 in cabinet/rack AB04.

This is somewhat redundant information given that the cabinet/rack and panel are clearly identified and are not usually required information on the port label since the cabinet/rack and panel are apparent to the viewer who is standing at the location of the port. Therefore a typical port label would have the following scheme:

01

This identifier defines that this is port 01.

Port Label Recommendations

Printer Type	Laser/Inkjet				
Cable Type	Copper	Copper	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Non-Adhesive	Non-Adhesive	Adhesive
Number of Ports	4	6	4	6	n/a
Label P/N	C261X030FJJ	C379X030FJJ	C261X035Y1J	C390X030Y1J	C350X100YJJ

Printer Type	LS8				
Cable Type	Copper	Copper	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Non-Adhesive	Non-Adhesive	Adhesive
Number of Ports	4	6	4	6	n/a
Label P/N	C252X030FJC	C379X030FJC	C261X035Y1C	C390X030Y1C	T100X000YPC-BK

Printer Type	Desktop Thermal		
Cable Type	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Adhesive
Number of Ports	4	6	n/a
Label P/N	C252X030YPT	C379X030YPT	C350X100YJT

Cable Labeling and Patch Cord Labeling

Next the cabling on the back and front of the cabinet/rack must be identified. Labeling of cables on the back of the panel is considered **cable labeling** and the labeling of cables connected to the front of the panel is considered **patch cord/equipment cord labeling**.

Cable Labels

Cables labels are identified with information that defines the connection between the near end panel connection and the far end panel connection. A near end connection identifier would consist of the cabinet/rack location, panel location, and port location. The far end connection identifier would consist of the cabinet/rack location, panel location, and port location.



A typical cable label would have information in the following scheme:

AB04-24:01/AB07-36:13

This identifier would be decoded to define the cable connects between cabinet AB04 panel 24 port 01 going to cabinet AB07 panel 36 port 13. The far end of the cable would have a label that would have the same but with the information reversed.

Recommended Cable Labels

Printer Type	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Flag	Flag	Self-Laminating
Label P/N	S100X150YAJ	S100X225YAJ	F102X220FJJ	F102X220FJJ	S100X225YAJ

Printer Type	LS8	LS8	LS8	LS8	LS8
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating for Label-Core	Self-Laminating for Label-Core	Self-Laminating
Label P/N	S100X150VAC	S100X225VAC	S100X160VAC	S100X220VAC	S100X225VAC

Printer Type	Desktop Thermal	Desktop Thermal	Desktop Thermal
Cable Type	Copper	Copper	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X150VAT	S100X225VAT	S100X225VAT

Patch Cord/Equipment Cord Labels

Patch cord/equipment cord labels are identified with information that defines the connection between the near end patch panel front connections and the far end patch panel front connections or equipment connections. A near end connection identifier would consist of the cabinet/rack location, panel location, and port location. The far end connection identifier would consist of the cabinet/rack location, panel location, and port location.



A typical patch cord label would have information in the following scheme:

AB04-24:01/AB04-36:13

This identifier would be decoded to define the patch cord connection between cabinet AB04 panel 24 port 01 going to the same cabinet panel 36 port 13. The far end of the cable would have a label that would have the same but with the information reversed.

A typical equipment cord label would information in the following scheme:

AB04-24:01/AB04-Tinley2:A

This identifier would be decoded to define the equipment cord connection between cabinet AB04 panel 24 port 01 going to the same cabinet port A on equipment named Tinley2. Rack unit location could be substituted for equipment name if necessary.

Recommended Patch/Equipment Cord Labels

Printer Type	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Flag	Flag	Self-Laminating
Label P/N	S100X150YAJ	S100X225YAJ	F102X220FJJ	F102X220FJJ	S100X225YAJ

Printer Type	LS8	LS8	LS8	LS8	LS8
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating for Label-Core	Self-Laminating for Label-Core	Self-Laminating
Label P/N	S100X150VAC	S100X225VAC	S100X160VAC	S100X220VAC	S100X225VAC

Printer Type	Desktop Thermal	Desktop Thermal	Desktop Thermal
Cable Type	Copper	Copper	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating

Label P/N	S100X150VAT	S100X225VAT	S100X225VAT
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Patch Panel Connectivity

Patch Panel connectivity is considered the most important area of infrastructure labeling in that it defines the critical connections between ports on patch panels and equipment. This information defines the connections between the near-end ports and the far-end ports. This labeling can define the connection of a range of ports on a panel or just define the connection for two individual ports.



A typical patch panel connectivity label would have the following scheme:

AB04-24:ports 01-12/AB07-36:ports 25-36

This identifier would be decoded to define the ports 01 through 12 on panel 24 of cabinet AB04 connect to ports 25 through 36 on panel 36 of cabinet AB07.

Recommended Patch Panel Connectivity Labels

Printer Type	Laser/Inkjet		
Media	Copper	Copper	Fiber
Ports	4 or less	more than 4	n/a
Label P/N	C252X030FJJ	C379X030FJJ	C350X100YJJ

Printer Type	LS8		
Media	Copper	Copper	Fiber
Ports	4 or less	more than 4	n/a
Label P/N	C252X030FJC	C379X030FJC	T100X000VJC-BK

Printer Type	Desktop Thermal		
Media	Copper	Copper	Fiber
Ports	4 or less	more than 4	n/a
Label P/N	C252X030YPT	C379X030YPT	C350X100YJT

Labeling For Other Systems

In addition to the data connections there are many other systems in a data center that require labeling.

Grounding and Bonding

LABELING OF THE GROUNDING AND BONDING SYSTEM INVOLVES THE IDENTIFICATION OF THE MAIN GROUNDING BUSBAR, GROUNDING BUSBARS, CONDUCTORS CONNECTING BUSBARS, CONDUCTORS CONNECTING DEVICES TO BUSBARS, AND EQUALIZING CONDUCTORS.

The typical scheme for the main grounding busbar would be:

1-B301-TMGB

This identifier can be decoded to define that this is the main telecommunications grounding busbar located on floor 1 in space B301.

The typical scheme for a grounding busbar would be:

2-R201-TGB

This identifier can be decoded to define that this is the telecommunications grounding busbar on floor 2 in space R201.

Recommended Telecommunications Grounding Busbar Labels

Printer Type	Laser/Inkjet	LS8	Desktop Thermal
Label P/N	C400X200YJJ	C200X100YPC	C400X200YPT

The typical scheme for the busbar connections would be:

1-B301-TMGB/2-R201-TGB

This identifier can be decoded to define that this is the conductor that connects the main telecommunications grounding busbar located on floor 1 in space B301 to the telecommunications grounding busbar on floor 2 in space R201.

Recommended Busbar Connections Labels

Printer Type	Laser/Inkjet				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075YAJ	S100X125YAJ	S100X225YAJ	S100X400YAJ	S100X650YAJ

Printer Type	LS8				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAC	S100X125VAC	S100X225VAC	S100X400VAC	S100X650VAC

Printer Type	Desktop Thermal				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAT	S100X125VAT	S100X225VAT	S100X400VAT	S100X650VAT

Power Cables

Labeling of the power system involves the labeling of the cables feeding power outlet units (POU) with information defining the source of power to the POU. This information would include the distribution panel and the circuit that feeds the POU.

A typical scheme for the power labeling would be:

AB03A-PP21-15

This identifier can be decoded to define that this is the power cable that connects POU A located in rack/cabinet AB03 to circuit breaker 15 in power panel 21.

Recommended Power Cable Labels

Printer Type	Laser/Inkjet				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075YAJ	S100X125YAJ	S100X225YAJ	S100X400YAJ	S100X650YAJ



Printer Type	LS8				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAC	S100X125VAC	S100X225VAC	S100X400VAC	S100X650VAC




Printer Type	Desktop Thermal				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAT	S100X125VAT	S100X225VAT	S100X400VAT	S100X650VAT

Safety, Fire and Security

Maintaining a safe workplace is essential to the proper operation of the data center. There are many potentially dangerous systems present in a data center such as fire suppressant systems, cooling systems, and power systems.

The following pre-printed labels can be installed in the data center.

Area	Part Number	Example
<p>ELECTRICAL HAZARDS</p>	<p>PPS0305W2100 PPS0710D73 PCV-120CY PCV-220CY PCV-480BY</p>	
<p>Fire Safety</p>	<p>PPS1209G010 PPS1209G011 PPS0710G001</p>	

		
<p>Piping</p>	<p>GPMSH-PY GPMSH-NY</p>	
<p>Security</p>	<p>PSL-DCJB PSL-DCPL</p>	

Appendix A

Parts List

Product	Description	Quantity
CJ6X88TG**	10gig cat 6 mini com jack	718
CPP24WBLY	24	TBD
CPPL24WBLY	24	TBD
CPPA24FMWBLY	24	TBD
CPP48WBLY	48	TBD
CPPL48WBLY	48	TBD
CPPA48FMWBLY	48	TBD
CN1CN	Cabinet frame with top panel. Includes dual hinging perforated front door, split perforated rear doors, solid side panels, two sets of cage nut equipment mounting rails, and 45 RU of cable management on front and rear of front posts.	1
CN2CN	Cabinet frame with top panel. Includes dual hinging perforated front door, split perforated rear doors, two sets of cage nut equipment mounting rails, and 45 RU of cable management on front and rear of front posts.	1
UTP6A3**	3 feet	TBD
UTP6A5**	5 feet	TBD
UTP6A7**	7 feet	TBD
FAP8WAQDLCZ	LC 10Gig™ OM3/OM4 FAP loaded with 8 LC 10Gig™ Duplex Multimode Fiber Optic Adapters (Aqua) with zirconia ceramic split sleeves	TBD
FAPB	Patch Panel Blank	TBD
FMT1	Fiber Enclosure Holds up to 4 FAPs	TBD
CFAPPBL1	FAP Adapter for up to 4 FAPs	TBD
FMT2	Fiber Enclosure Holds up to 8 FAPs	TBD
CFAPPBL2	FAP Adapter for up to 8 FAPs	TBD
FXE10-10M1Y	1-Meter Multi-mode OM3 10Gig Duplex LC	TBD
FXE10-10M2Y	2-Meter Multi-mode OM3 10Gig Duplex LC	TBD
FXE10-10M3Y	3-Meter Multi-mode OM3 10Gig Duplex LC	TBD
FXE10-10M5Y	5-Meter Multi-mode OM3 10Gig Duplex LC	TBD