

## Appendix J - NRPS Cabling Specs

# Niagara Regional Police Service Network Cabling Specifications

April 25th 2108

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**NIAGARA**  
REGIONAL POLICE SERVICE

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## Specification Version History

Version #	Implemented	Revision	Approved	Approval	Reason
1	Matt Kohut				

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## I. General

### A. Purpose of Document

1. This document is to provide a standard defining the structured communications cabling systems to be installed within Niagara Regional Police Service facilities. It is geared toward leveraging our legacy cabling infrastructure while upgrading to more recent technologies in new installations. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards, and industry best practices.
2. Within this document, the facilities owner is Niagara Regional Police Service, and shall be referred to as such, or as Information Technology. Bidding low-voltage installers shall be referred to as "Installer" or "Contractor".
3. It is the responsibility of the installing Contractor to evaluate these general recommendations and adapt them effectively to actual projects. Contractor is responsible for identifying and bringing to the attention of Niagara Regional Police Service any design directions that may be improved. All such changes shall be approved in writing from Information Technology.
4. This specification defines quality standards and practices common to all Niagara Regional Police Service network cabling upgrades and Greenfield (new) projects. The system offered and quoted, shall incorporate all features and facilities listed in this specification.
5. In addition to this cabling standard, individual projects will also have associated documentation such as Requests for Proposals (RFP), facility drawings, and project schedules pertaining to that particular job. Such collateral will be referred to in this document as "Project-specific Documentation", "Project Documentation", or simply "Construction Documents". Many of the requirements described herein may be detailed or expanded upon by such project-specific documents.
6. Any conflict between this general specification and any project-specific documentation shall be brought to the attention of Niagara Regional Police Service and will be resolved by Niagara Regional Police Service in writing.
7. Note that while many portions of this specification are addressed to "The Contractor", these requirements apply equally to architects, engineers, project managers, planning, or anyone doing network cabling and infrastructure work within Niagara Regional Police Service facilities, whether those persons are outside contractors or persons directly employed by Niagara Regional Police Service.

### B. Scope of Work – Typical

1. Contractor shall be solely responsible for all parts, labor, testing, documentation, and all other processes and physical apparatus necessary to turn over the completed cabling system and associated infrastructure fully warranted and operational for acceptance by Niagara Regional Police Service.

2. This specification includes structured cabling for the production Ethernet network, but may address other systems that have converged onto Ethernet-style cabling. These associated systems may include VoIP, Building Automation Systems (BAS), Building Access Control, Security Cameras and Audio-Visual Systems.
3. The following cabling subsystems will be defined:
  - a. Cabling Subsystem 1 – Horizontal Copper Cabling
  - b. Cabling Subsystem 2 – Intrabuilding Fiber Backbone Cabling OM4
  - c. Cabling Subsystem 3 – Interbuilding Fiber Backbone Cabling OM4
  - d. Racks and Cable Management
  - e. Bonding and Grounding
  - f. Cable Pathways
  - g. Network Labeling
  - h. Cabling Accessories
  - i. Cabling Subsystem 1 – Horizontal Copper Cabling
  - j. Cabling Subsystem 2 – Intrabuilding Fiber Backbone Cabling OM4
  - k. Cabling Subsystem 3 – Interbuilding Fiber Backbone Cabling OM4
  - l. Racks and Cable Management
  - m. Bonding and Grounding
  - n. Cable Pathways
  - o. Network Labeling
  - p. Cabling Accessories
4. In the event that requirements of the project documents cannot be met during design or installation, a written description of the need for variance will be submitted to the Niagara Regional Police Service Project Manager for review by the Information Technology Team.

## **C. General Guidelines**

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1. All voice telephony systems shall be VoIP unless otherwise specified in the project-specific documentation.
2. Any copper or fiber patch cords shall be factory terminated. Hand terminated patch cords will not be accepted.
3. All Greenfield (new) projects shall use Cat 6A cable.

4. On Brownfield (existing) installations, Contractor shall consult project documentation for guidance on the current Category of copper cable to be installed.
5. Any deviation from Cat 6A cabling shall be approved in writing by Matt Kohut.
6. Wiring configuration on Cat 6A systems shall be T568A.
7. Any communications/IT consulting engineers retained by Niagara Regional Police Service shall be at the sole discretion of Information Technology.

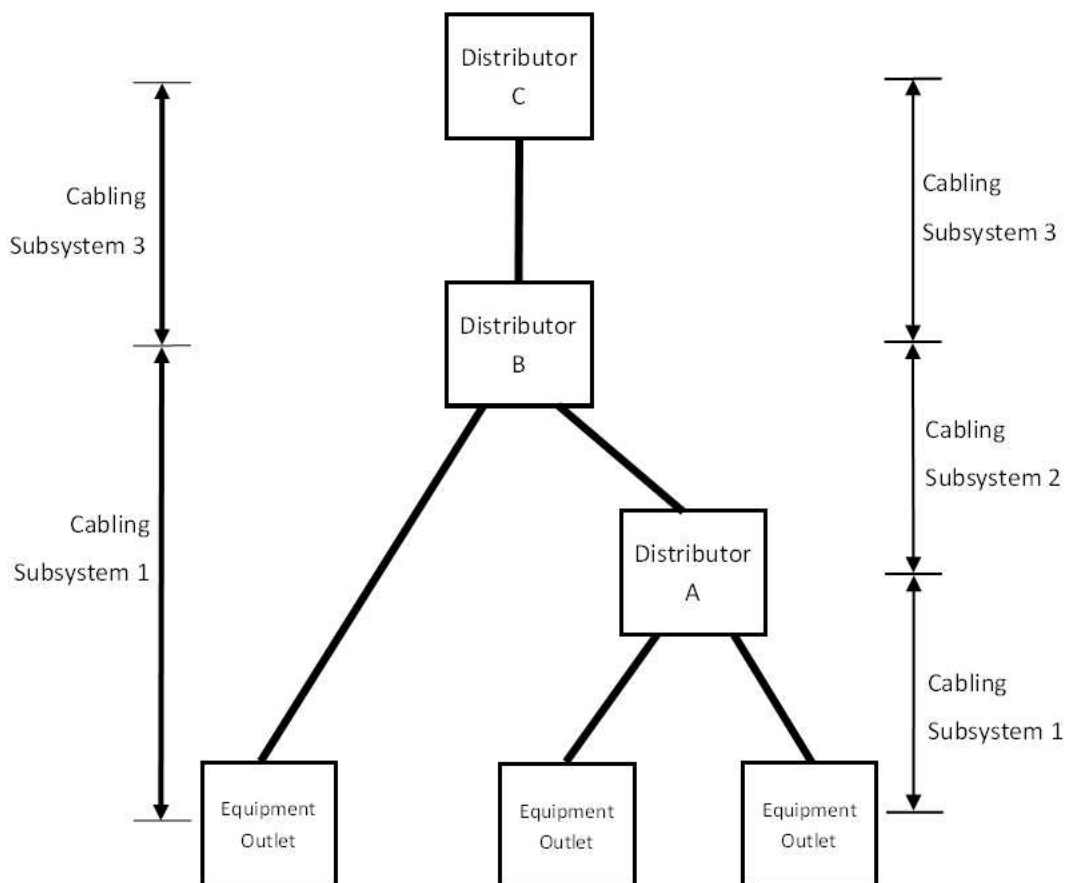
## D. Terminology from TIA 569

1. New Terms for Telecommunications Spaces (Rooms)
  - a. This section reviews some of the current terminology for communications rooms and spaces as defined in TIA 569-D (April 2015).
  - b. Awareness of these new terms is important for communicating accurately and for clearly understanding language used in specifications and other documents.
  - c. This specification will use both new and old terms side-by-side for clarity.
  - d. The table below shows some of the most important new terms and how they relate to traditional terminology:

Old Term(s)	New Term
Entrance Facility.	Entrance Room
Telecommunications Room, Equipment Room.	Distributor Room
Telecommunications Room, Equipment Room.	Telecommunications Space
Cross-connect, Patching System, Optical Enclosure.	Distributor
Horizontal Cross-connect. Usually copper patch panels in enterprise installations.	Distributor A
Intermediate Cross-connect, Intermediate Distribution Frame. Usually multimode optical enclosure in enterprise installations. Can apply to intra and interbuilding fiber cabling subsystems.	Distributor B
Main Cross-connect, Main Distribution Frame. Usually singlemode optical enclosure in enterprise installations. Can apply to intra and interbuilding fiber cabling subsystems.	Distributor C
Faceplate, Surface Box, Work Area Appliance.	Equipment Outlet
Work Area.	Equipment Outlet Location
Horizontal Cabling. Extends from Equipment Outlet to Distributor A, B, or C depending on size of cable plant. Usually balanced twisted pair cable in enterprise installations.	Cabling Subsystem 1
Extends from Distributor A to Distributor B or C, depending on size of cable plant.	Cabling Subsystem 2

Old Term(s)	New Term
Usually 50-micron intra-building backbone fiber cable in enterprise installations. But may be singlemode fiber.	
Connects Distributor A to Distributor B. In enterprise installations, this is usually singlemode fiber between buildings.	Cabling Subsystem 3

Example of a logical cabling topology with the new terminology see illustration below:





## **E. Applicable Regulatory References**

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1. Contractor is responsible for knowledge and application of current versions of all applicable standards and codes.
2. ANSI/TIA:
  - a. ANSI/TIA 568 series, most recent revisions, addenda and systems bulletins. All applicable
  - b. ANSI/TIA-569 Telecommunications Pathways and Spaces, most recent revision including all relevant addenda and systems bulletins
  - c. ANSI/TIA-606 Administration Standard for Telecommunications Infrastructure, most recent revision including all addenda and systems bulletins
  - d. ANSI/TIA-607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, most recent revision including all addenda and systems bulletins
  - e. ANSI/TIA-862 Structured Cabling Infrastructure Standard for Intelligent Building Systems, most recent revision including all addenda and systems bulletins
  - f. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers, most recent revision including all addenda and systems bulletins
  - g. ANSI/TIA-1179 Healthcare Facility Telecommunications Infrastructure Standard, most recent revision including all addenda and systems bulletins
  - h. ANSI/TIA-4966 Telecommunications Infrastructure Standard for Educational Facilities, most recent revision including all addenda and systems bulletins
  - i. TIA-TSB-162 Telecommunications Cabling Guidelines for Wireless Access Points, most recent revision including all addenda and systems bulletins
3. BICSI – Building Industry Consultative Services International – Manuals
  - a. Telecommunications Distribution Methods Manual, most recent edition
  - b. Information Transport Systems Installation Methods Manual (ITSIMM), most recent edition
4. National Electric Codes – all applicable
5. OSHA Standards and Regulations – all applicable
6. Local Codes and Standards – all applicable
7. Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either
8. Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense

## **F. Niagara Regional Police Service Substitution Policy**

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1. This is a performance-based specification developed from the experience of the Niagara Regional Police Service Information Technology in providing exceptional solutions for all our facilities and departments. As such, substitution of specified products or systems named in this document is highly discouraged.
2. Any Contractor wishing to offer substitutions for any part of the systems specified herein shall be responsible for proving equivalency and shall follow the procedure below:
  - a. Contractor shall submit a request for product substitution to Niagara Regional Police Service in writing no less than one week in advance of bid.
  - b. Contractor shall provide three (3) each samples of the product being offered for evaluation by Niagara Regional Police Service
  - c. Samples of products offered for substitution shall be accompanied by product drawings, specification sheets and engineering documents proving equivalency in transmission performance (where applicable) and mechanical function.
  - d. Category Cat 6A cable and components offered in substitution to those specified shall be accompanied by third party test reports proving equal or better channel performance. Such test reports shall name exact products by part number and state channel results in worst-case connector links of maximum length that include both cross-connect and consolidation points.
3. Equivalent product acceptance must be received from Niagara Regional Police Service in writing.
4. Contractor shall be responsible for and assume all costs for removal and replacement of any substituted product installed without prior written approval from Niagara Regional Police Service. Such costs shall include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

## **G. Contractor Qualifications**

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1. General
  - a. Contractor shall be a current Panduit One<sup>SM</sup> Partner that has completed the Structured Cabling Deployment training (Panduit Certified Installer). A copy of the corporate Panduit manufacturer certification shall be included with all quotes.
  - b. Contractor shall have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.
  - c. Contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD) to sign-off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.
  - d. Contractor shall have all necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.

- e. At least 30 percent of the technicians installing low-voltage copper systems on the job shall have a current Panduit Certified Copper Technicians certificate.
- f. At least 30 percent of the technicians installing any Fiber Distribution Systems shall have a current Panduit Certified Fiber Technicians certificate.
- g. The Telecommunications contractor shall provide a Project Manager to serve as the single point of contact to manage the installation, speak for the contractor and provide the following functions:
  - Initiate and coordinate tasks with the Niagara Regional Police Service Project Manager and others as specified by the project schedule.
  - Provide day-to-day direction and-site supervision of Contractor personnel.
  - Ensure conformance with all contract and warranty provisions.
  - Acknowledge and remediate findings of Niagara Regional Police Service weekly site project meetings.
  - This individual will remain Project Manager for the duration of the project. The contractor may change Project Manager only with the written approval of Niagara Regional Police Service.
- h. Contractor Project Manager on site shall have completed the Panduit Structured Cabling Deployment training and hold certificates for both copper and fiber.

## 2. References and Response Times

- a. Communication Contractor shall provide with bid, a list of four (4) reference accounts where similar Data, Voice, Fiber Optic Cable, and related equipment installation work was performed within the last year (twelve-month period).

## 3. Termination of Services

- a. Niagara Regional Police Service reserves the right to terminate the Communication Contractor's services if at any time it is determined the Communication Contractor is not fulfilling their responsibilities as defined within this document and all associated project documentation.
- b. Upon termination, the Communications Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.
- c. Contractor's appearance and work ethic shall be of a professional manner. Dress shall be appropriate to the work being performed.
- d. Conduct on Niagara Regional Police Service property will be professional in nature.
- e. Any person in the Contractor's employ working on a Niagara Regional Police Service project considered by Niagara Regional Police Service to be incompetent, disorderly, or for any other reason unsatisfactory or undesirable to Information Technology, such person shall be removed from the Niagara Regional Police Service project.

## 4. Other Contractor Responsibilities

- a. Confirmation of Pathway and Cable Manager sizing:
  - Wherever cabling pathways or managers are installed, it is the Contractor's responsibility to confirm pathway or manager sizing to represent no more than 25% fill upon installation according to manufacturer's fill tables.
  - Pathways deemed overfilled upon installation will not be accepted and shall be remedied at Contractor expense.
- b. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job.
- c. All work areas will be cleaned at the conclusion of the workday and no tools or materials shall be left in a manner as to pose a safety hazard.
- d. Projects are not considered finished and will not be paid by Niagara Regional Police Service until all debris, dust, etc. has been cleaned and removed to the satisfaction of Niagara Regional Police Service.
- e. Contractor shall remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. Removal of orphaned cable is mandatory. Contractors shall consider this when placing bids.
- f. Contractor shall abide by all Niagara Regional Police Service Security Policies pertaining to access and conduct while on Niagara Regional Police Service property.
- g. Contractor shall obey all posted speed limits and parking regulations at the Niagara Regional Police Service facilities where the work is being performed.
- h. Contractor understands that illegally parked vehicles will be towed and Contractor is responsible for and will assume all costs associated with towing.

## **H. Warranty**

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1. Contractor shall provide a 25-year PanGen® System Warranty on all copper and fiber links and/or channels.
2. PanGen® System Warranty shall meet the following criteria:
  - a. A 25-year guarantee that the installed cabling system will pass the Commercial Building Telecommunications Standards cited in this document.
  - b. This warranty will cover all registered links and/or channels.
  - c. Contractor shall indicate in warranty documentation whether registered links are to be link or channel.
    - If links are covered, this warranty may be invoked only if the links are comprised entirely of Panduit components in combination with General Cable.
    - If channels are covered, this warranty may be invoked only if entire channel links are comprised of continuous Panduit components and patch cables in combination with General Cable.
  - d. The communications Contractor will correct any problems and malfunctions that are warranty-related issues without charge for the entire warranty period.

- e. If the PanGen® System Warranty is needed by Niagara Regional Police Service within the warranted period and the original installer is no longer in business, Panduit shall find a substitute Panduit ONE<sup>SM</sup> (certified) contractor and assume costs to fulfill the obligations of the warranty.
- f. Upon acceptance of the warranty paperwork and test results from the Contractor, Panduit will mail a notification letter to the installer and a notification letter with warranty certificate to Niagara Regional Police Service.
- g. The warranty period shall commence following the final acceptance of the project by Niagara Regional Police Service and written confirmation of warranty from Panduit.

<END OF SECTION>

## II. Subsystems and Components

### A. Cabling Subsystem 1 – Horizontal Copper Cabling System

1. See Appendix A for Part Numbers
2. Installation Guidelines
  - a. Installation of horizontal cabling shall be compliant with most recent versions of all applicable standards, national and local codes, as well as the local Authority Having Jurisdiction (AHJ).
  - b. The cabling system and support hardware shall be installed so as not to obscure any valves, fire alarm conduit, boxes, or other control, security or life safety devices.
  - c. Contractor shall use the same Category of performance for both cable and connecting hardware through the entire horizontal channel.
  - d. Anywhere there is a conflict between standards, codes, installation specifications or project specific documentation contractor shall default to the most stringent.
  - e. If clarification is needed, contractor shall submit a written request for clarification to Niagara Regional Police Service. Response from Niagara Regional Police Service shall be in writing.
  - f. All cable pulled and terminated shall be Cat 6A unless specified otherwise in the project documentation.
  - g. Contractor is responsible for maintenance of maximum pulling tensions, minimum bend radius, and approved termination methods required by cited standards, as well as manufacturer's recommendations and industry accepted best practices.
  - h. Contractor shall use low to moderate force when pulling cable. Maximum tensile load may not exceed 25' lbs. maximum pulling force per 4 pair cable.
  - i. Bundles of cable shall be pulled using pulling socks to distribute the tensile force over all cables in the bundle.
  - j. Contractor shall take care not to knot, snag or otherwise deform the cable while pulling. The jacket on installed cable shall be continuous, free from pinholes, splits, blisters, burn holes or other imperfections. Damaged or deformed cable shall be removed and replaced at no cost to Niagara Regional Police Service.
  - k. Bend radius on 4 pair cable shall never be below 4 times the cable outer diameter, or manufacturer's requirements, whichever is most stringent.
  - l. Cables shall not be attached to lighting support wires nor touch the drop-ceiling assembly. Any portion of the communications cabling making contact with ceiling structures shall be remedied at Contractor expense.
  - m. Cables shall be kept as far away from potential sources of EMI (electrical cables, transformers, light fixtures, etc.) as practical and in shall in no cases pass closer than recommended in cited TIA standards.

- n. When using miniature horizontal cable or small diameter patch cables, the channel length shall be derated per manufacturer's recommendations.
- o. Contractor shall take care to never deform the cable by over cinching with cable ties. All cable ties shall be cinched firmly, but not so firmly that the tie cannot be rotated or moved on the bundle by hand.
- p. Cable bundles in telecom spaces (rooms) shall be dressed using only hook and loop style cable ties. Plastic ties shall not be used in Niagara Regional Police Service telecom rooms and shall be removed and replaced with hook and loop ties at Contractor expense.
- q. Cable ties on all cable bundles shall be applied at random intervals to avoid harmonic effects.
- r. All horizontal cabling installed shall include a cable slack loop of not less than 12 inches at the Equipment Outlet and not less than 36 inches in the horizontal telecom room.
- s. Equipment outlet cable slack shall be stored in the box behind the faceplate if there is room to do so without violating the bend radius of the cable according to manufacturer's recommendations.
- t. Contractor may affix 12-inch slack loop above ceiling using hook and loop cable ties if allowed in the project specific documentation or otherwise in writing from Niagara Regional Police Service. Cable loops touching the drop ceiling shall not be accepted.
- u. Service loops in the telecommunications room may be wall mounted or contained in pathways or racking systems if done according to manufacturer and industry best practices.
- v. All terminations on new (Greenfield) Niagara Regional Police Service projects shall be terminated using the T568A pin-out (wire map).
- w. All terminations in existing Niagara Regional Police Service facilities (Brownfield), shall match the pin-out and Category of the legacy cable plant, unless otherwise specified in the project documentation.
- x. Contractor shall terminate twisted pairs so that the last twist is never more than ½ inch from the point of termination (insulation displacement clip). Maintaining the last twist closer than ½ inch is preferred.
- y. Contractor shall maintain the cable jacket as close as possible to the connecting hardware. Twisted pair conductors deemed by Niagara Regional Police Service to be unnecessarily exposed shall be re-terminated at Contractor's expense.
- z. Contractor shall be responsible for using plenum cable, ties and appliances in any air-return (plenum) spaces as required by applicable codes, standards, and the local AHJ (Authority Having Jurisdiction).

### 3. Copper Horizontal Cable

- a. Copper cable shall have the following attributes:
  - Category 6A/Class EA cable shall be constructed of 23 AWG copper conductors with FEP Plenum (CMP) insulation.
  - Certified channel performance in a 4-connector configuration up to 100 meters and exceeds the requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA standards swept up to 650 MHz for supporting 10GBASE-T transmission over twisted-pair cabling systems as part of the Panduit® TX6A™ 10Gig UTP Copper Cabling System.

- Certified component performance up to 100 meters and exceeds the ANSI/TIA-568-C.2 Category 6A and IEC 61156-5 Category 6A standards for supporting 10GBASE-T transmission over twisted-pair cabling systems.
4. Equipment Outlet Copper Connectors (Jacks)
    - a. Copper Connectors shall have the following attributes:
      - Category 6A/Class EA, 8-position, UTP jack module shall terminate 4-pair, 22 – 26 AWG, 100-ohm unshielded twisted pair cable and shall not require use of a punchdown tool
      - The termination cap shall be color-coded blue to designate Category 6A performance and shall include a universal label coded for T568A and T568B wiring schemes
  5. Equipment Outlet Appliances – Faceplates
    - a. Faceplates shall have the following attributes:
      - [Attribute 1]
      - [Attribute 2]
  6. Equipment Outlet Appliances – Surface Mount Boxes
    - a. Surface Mount Boxes shall have the following attributes:
      - [Attribute 1]
      - [Attribute 2]
  7. Copper Horizontal Patch Panels (Distributor A)
    - a. Patch panels shall have the following attributes:
      - [Attribute 1]
      - [Attribute 2]
  8. Copper Patch Cords – Work Area
    - a. Copper patch cords shall have the following attributes:
      - [Attribute 1]
      - [Attribute 2]
  9. Copper Patch Cords – Telecom Room
    - a. Copper patch cords shall have the following attributes:
      - [Attribute 1]



- [Attribute 2]

#### 10. Zone Cabling

- Wireless Access Points shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]
- MUTOAs – Multi-user-termination-outlet-assemblies shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]
- Consolidation points shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]
- Zone Enclosures shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 11. Special Applications

- Field Term Plugs shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 12. Other Work Area Connectors

- Other work area connectors shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### **B. Cabling Subsystem 2 – Intrabuilding (Within Building) Fiber**

- See Appendix A for Part Numbers
- Installation Guidelines (Applies to all Fiber Trunks)
  - Fiber terminations shall be done according to recommendations of TIA, manufacturer's requirements, and accepted industry best practices.

- b. Fiber optic cabling system additions and upgrades to existing facilities (Brownfield) shall match the fiber type (OM/OS designation) of the system to which it is being installed. Contractor shall under no circumstances mix different OM/OS classes of cable or termination devices (connectors) within the same channel unless specifically instructed to do so within the project specific documentation.
- c. When installing fiber cable, Contractor shall maintain a minimum bend radius of 20 times the outer diameter of the cable when it is under load (being pulled).
- d. Fiber service loops shall be stored to maintain a minimum bend radius of 10 times the outer diameter of the cable.
- e. Optical fiber shall only be pulled using its internal strength member in conjunction with a properly rated multi-weave mesh grip and swivel pulling eye.
- f. All unjacketed fiber shall be contained within appropriate fiber enclosures. Exposed tight-buffered, fan-out or loose-tube strands will not be tolerated and shall be remedied at Contractor's expense.
- g. Direct connection of terminated fiber backbone links to equipment is not allowed. All fiber connections shall go through a fiber enclosure interconnect and connect to active equipment via fiber jumpers.
- h. Contractor shall perform fiber testing of all strands according to guidelines in the "Testing and Acceptance" section of this document.
- i. Service loop (slack) in telecommunications rooms shall be at least 3 meters. Consult project documentation for length of service loops and storage method within a specific telecom room or space.
- j. Slack shall be stored per manufacturer instructions inside the enclosure, or stored outside the enclosure using appliances built for that purpose. Consult project documentation for details on storage of service loops.
- k. Fiber pulls using multiple pull points shall use the "figure-8" technique any time excess cabling is piled on the floor as slack to supply the next pull-point.
- l. Cable shall be rolled off the spinning cable reel, not pulled off the end.
- m. During all fiber cable pulls Contractor shall have one person at each end of the pull to ensure proper cable pay out and pile up without damage to the fiber.
- n. Fiber backbone cables shall be installed separately from horizontal distribution cables. Under no circumstances may copper and fiber cables be pulled in common bundles.
- o. In pathways containing both fiber and copper cables, the fiber cable must either be of armored construction, or segregated in innerduct.
- p. Where cables are housed in sleeves or conduits, the backbone and horizontal cables shall be installed in separate conduits or the fiber segregated in separate innerduct within the conduits.
- q. Fiber shall be segregated within racks and patching systems unless instructed otherwise in the project documentation.
- r. Where possible fiber enclosures shall be mounted at the top of equipment racks and the fiber cable kept separate from copper cable.

- s. Contractor shall inspect fiber end faces with a fiber scope and clean the connectors (if needed) whenever plugging in a fiber connector.

### 3. Fiber Between Telecom Rooms on the Same Floor

- a. Backbone fiber cable between telecoms rooms on the same floor within building shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 4. Fiber Between Telecom Rooms on Different Floors

- a. Backbone fiber cable between telecoms rooms on different floors within building shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 5. Intrabuilding Fiber Cable (Optical Multimode)

- a. Intrabuilding fiber cable between telecoms rooms on different floors within building shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 6. Fiber Connectors

- a. Intrabuilding fiber connectors shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 7. Fiber Enclosures (Distributor B)

- a. Intrabuilding fiber enclosures shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]
- b. Fiber Adapter Panels shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]
- c. Fiber Splice Trays and Tray Holders shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

#### 8. Fiber Patch Cords (jumpers)

- a. Fiber patch cords (jumpers) for intrabuilding fiber shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 9. Fiber Pig Tails

- a. Fiber pig tails used in intrabuilding fiber shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### **C. Cabling Subsystem 3 – Interbuilding (Between Buildings) Fiber**

#### 1. See Appendix A for Part Numbers

#### 2. Installation Guidelines

- a. Fiber terminations shall be done according to recommendations of TIA, manufacturer's requirements, and accepted industry best practices.
- b. Fiber optic cabling system additions and upgrades to existing facilities (Brownfield) shall match the fiber type (OM/OS designation) of the system to which it is being installed. Contractor shall under no circumstances mix different OM/OS classes of cable or termination devices (connectors) within the same channel unless specifically instructed to do so within the project specific documentation.
- c. When installing fiber cable, Contractor shall maintain a minimum bend radius of 20 times the outer diameter of the cable when it is under load (being pulled).
- d. Fiber service loops shall be stored to maintain a minimum bend radius of 10 times the outer diameter of the cable.
- e. Optical fiber shall only be pulled using its internal strength member in conjunction with a properly rated multi-weave mesh grip and swivel pulling eye.
- f. All unjacketed fiber shall be contained within appropriate fiber enclosures. Exposed tight-buffered, fan-out or loose-tube strands will not be tolerated and shall be remedied at Contractor's expense.
- g. Direct connection of terminated fiber backbone links to equipment is not allowed. All fiber connections shall go through a fiber enclosure interconnect and connect to active equipment via fiber jumpers.
- h. Contractor shall perform fiber testing of all strands according to guidelines in the "Testing and Acceptance" section of this document.

- i. Service loop (slack) in telecommunications rooms shall be at least 3 meters. Consult project documentation for length of service loops and storage method within a specific telecom room or space.
- j. Slack shall be stored per manufacturer instructions inside the enclosure, or stored outside the enclosure using appliances built for that purpose. Consult project documentation for details on storage of service loops.
- k. Fiber pulls using multiple pull points shall use the “figure-8” technique any time excess cabling is piled on the floor as slack to supply the next pull-point.
- l. Cable shall be rolled off the spinning cable reel, not pulled off of the end.
- m. During all fiber cable pulls Contractor shall have one person at each end of the pull to ensure proper cable pay out and pile up without damage to the fiber.
- n. Fiber backbone cables shall be installed separately from horizontal distribution cables. Under no circumstances may copper and fiber cables be pulled in common bundles.
- o. In pathways containing both fiber and copper cables, the fiber cable must either be of armored construction, or segregated in innerduct.
- p. Where cables are housed in sleeves or conduits, the backbone and horizontal cables shall be installed in separate conduits or the fiber segregated in separate innerduct within the conduits.
- q. Fiber shall be segregated within racks and patching systems unless instructed otherwise in the project documentation.
- r. Where possible fiber enclosures shall be mounted at the top of equipment racks and the fiber cable kept separate from copper cable.
- s. Contractor shall inspect fiber end faces with a fiber scope and clean the connectors (if needed) whenever plugging in a fiber connector.

### 3. Fiber Cable Between Buildings

- a. Backbone fiber cable between buildings shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 4. Fiber Connectors

- a. Fiber connections between buildings shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 5. Fiber Enclosures (Distributor C)

- a. Fiber enclosures for fiber links between buildings shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

#### 6. Fiber Adapter Panels

- a. Fiber adapter panels to populate enclosures on fiber links between buildings shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 7. Fiber Splice Trays and Tray Holders

- a. Fiber splice trays and tray holders used in enclosures for fiber links between buildings shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 8. Fiber Patch Cords (jumpers)

- a. Fiber patch cords (jumpers) for patching fiber links between buildings shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 9. Fiber Pig Tails

- a. Fiber pig tails used for splicing fiber links between buildings shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### **D. Racks, Cabinets, and Cable Management**

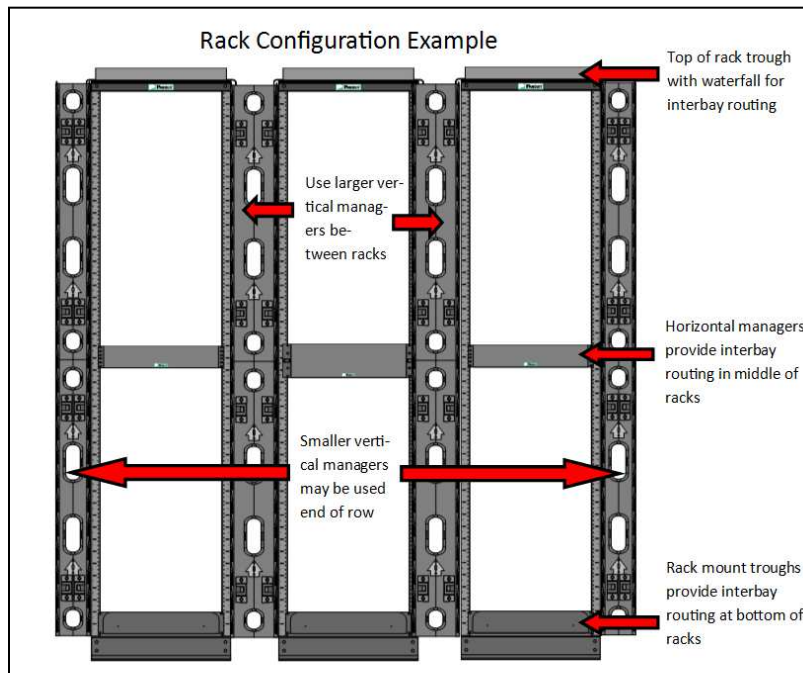
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#### 1. See Appendix A for Part Numbers

#### 2. Installation Guidelines

- a. Racks shall be securely attached to the concrete floor using appropriate mounting hardware.
- b. All racks shall be grounded to the telecommunications ground bus bar in accordance with cited standards the bonding and grounding section of this document.
- c. Rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation

- d. In telecommunications rooms with multi-bay rack rows, Contractor is responsible to include in design interbay routing pathways at the top, middle, and bottom of each rack to provide efficient and neat patch routing between any two points within rack rows.
- e. See the 2-post rack configuration example below for general guidelines for pathways between ganged racks:



- f. For bottom-of-rack interbay routing where cable quantities exceed capacity of interbay troughs, Contractor should substitute 4RU troughs.
- g. All racks shall be outfitted with a vertical grounding busbar along one rail, with all equipment bonded to ground according to the Bonding and Grounding Standards cited in this document. See Bonding and Grounding section of this document for details.
- h. Cabinets should be positioned to create aisle widths able to accommodate the movement and installation of the largest equipment anticipated.
- i. Minimum aisle width is 3 feet clearance in the front of the cabinet and not less than 2 feet of clearance in the rear. Consult project documentation for clearance requirements on a specific job.
- j. Cabinets shall be secured to the building structures according to the manufacturer's instructions and in compliance with applicable codes, standards, and the requirements of the local AHJ. Please also refer to project-specific documentation as appropriate.
- k. Racks and cabinets shall be individually electrically bonded to the communications earthing system according to the manufacturer's instructions and in compliance all applicable standards, codes and the requirements of the local AHJ.

- I. All cabinets shall be clearly identified at both the top and bottom of the in both the front and back of each cabinet with a large label (not less than 1” in height). Labels must be visible with the cabinet doors open or closed.
      - m. Empty horizontal spaces in cabinets in equipment rooms may be blanked with panels or blanking shades to facilitate hot/cold aisle cooling strategies. Consult project documentation for blanking requirements.
      - n. Cable entrances in tops of cabinets shall be sealed using preinstalled brushes or using the appropriate sized Panduit cool boot seals.
3. Two-Post Communications Racks
  - a. Two-post communications racks shall have the following properties:
    - [Attribute 1]
    - [Attribute 2]
4. Four-Post Communication Racks
  - a. Four-post communications racks shall have the following properties:
    - [Attribute 1]
    - [Attribute 2]
5. Rack-mounted Cable Management – Vertical Managers
  - a. Contractor shall size vertical cable managers to represent not more than 25% fill by manufacturer tables based on worst cast density estimates.
  - b. Contractor shall use larger vertical cable managers between racks as described elsewhere in this section.
  - c. Rack-mounted cable management – vertical managers shall have the following properties:
    - [Attribute 1]
    - [Attribute 2]
6. Rack-mounted Cable Management – Horizontal Managers
  - a. Contractor shall size horizontal cable managers to represent not more than 25% fill by manufacturer tables based on worst cast density estimates.
  - b. Rack-mounted cable management – horizontal managers shall have the following properties:
    - [Attribute 1]
    - [Attribute 2]



## 7. Rack Interbay Pathways – Top

- a. Rack interbay pathways – top troughs shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

## 8. Rack Interbay Pathways – Middle

- a. Rack interbay pathways – middle shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

## 9. Rack Interbay Pathways – Bottom

- a. Rack interbay pathways – bottom shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

## 10. Rack Cable Management Accessories – Fingers

- a. Rack cable management finger accessories shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

## 11. Rack / Cabinet Cable Management Accessories – Bend Radius Control Devices

- a. Rack / cabinet cable management bend radius control devices shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

## 12. Rack / Cabinet Cable Management Accessories – Stand-Off Brackets

- a. Rack / cabinet cable management stand-off brackets shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

## 13. Rack / Cabinet Cable Management Accessories – Nylon Hooks

- a. Rack / cabinet cable management nylon hook accessories shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

#### 14. Switch Cabinets

- a. Switch cabinets shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

#### 15. Server Cabinets

- a. Server cabinets shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### **E. Communications Grounding Network**

---

1. See Appendix A for Part Numbers
2. Installation Guidelines
  - a. Contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA Standards.
  - b. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the entrance facility or distributor (telecom) rooms shall be grounded to the respective PBB (Primary Bonding Busbar otherwise known as TMGB – Telecommunications Main Grounding Busbar) or SBB (Secondary Bonding Busbar otherwise known as TGB – Telecommunication Grounding Busbar) using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
  - c. Metallic panels attached to the rack or cabinet shall be bonded to the rack or cabinet using a green thread forming screw.
  - d. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack-mount equipment.
  - e. All jacketed wires used for telecommunications grounding purposes should be identified with green or green with yellow stripe insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape.
  - f. All cables and busbars shall be identified and labeled in accordance with the labeling standards cited in the Regulatory References section of this specification.

- g. The TBB (Telecommunications Bonding Backbone) shall adhere to the recommendations of the ANSI/TIA grounding and bonding standards cited in the Regulatory References section of this document, and shall be installed in accordance with cited standards and best industry practices.
- h. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

### 3. Room Busbars

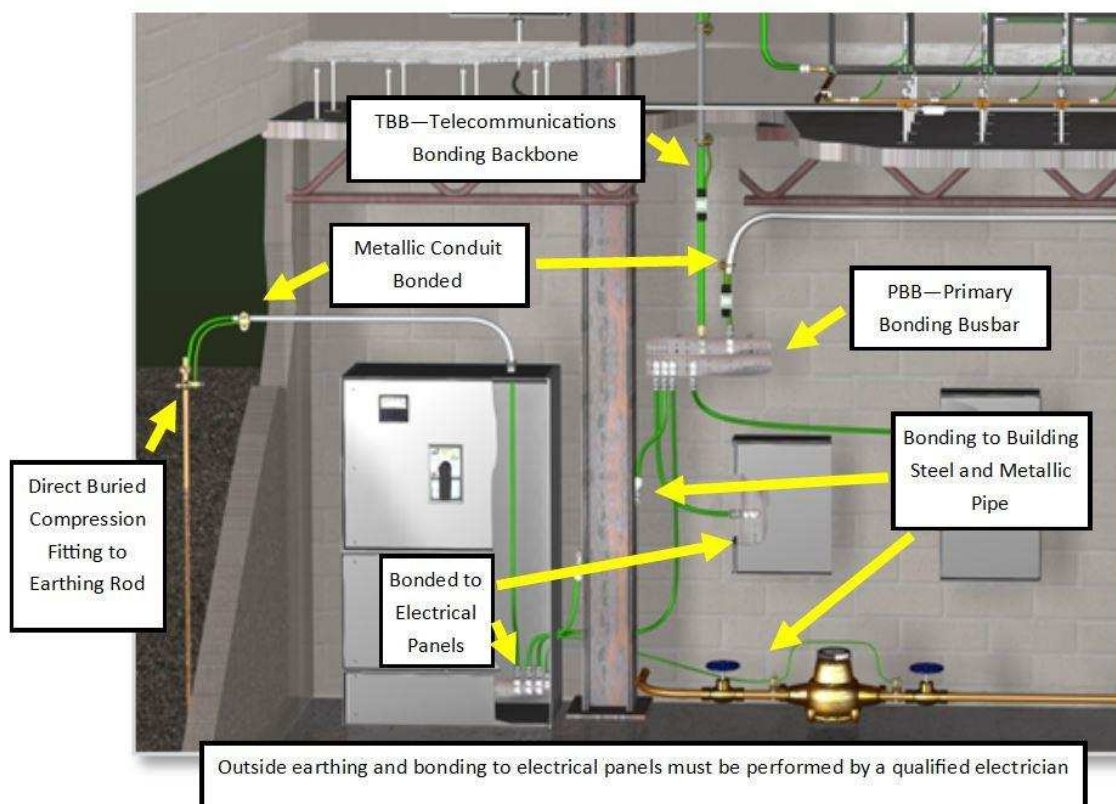
- a. All Telecommunications spaces and distributor rooms shall have installed an appropriately sized wall-mount busbar with BICSI hole spacing that bonds to the building bonding backbone.
- b. Telecommunications spaces and distributor room busbars shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

### 4. Bonding to the Service Equipment (Power) Ground

- a. The bonding conductor for telecommunications shall bond the PBB (Primary Bonding Busbar) to the service equipment (power) ground and building steel.
- b. Bonding conductors for telecommunications shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

### 5. Entrance Room

- a. The following figure illustrates the grounding in an Entrance Room.



- b. Entrance room bonding shall have the following properties:

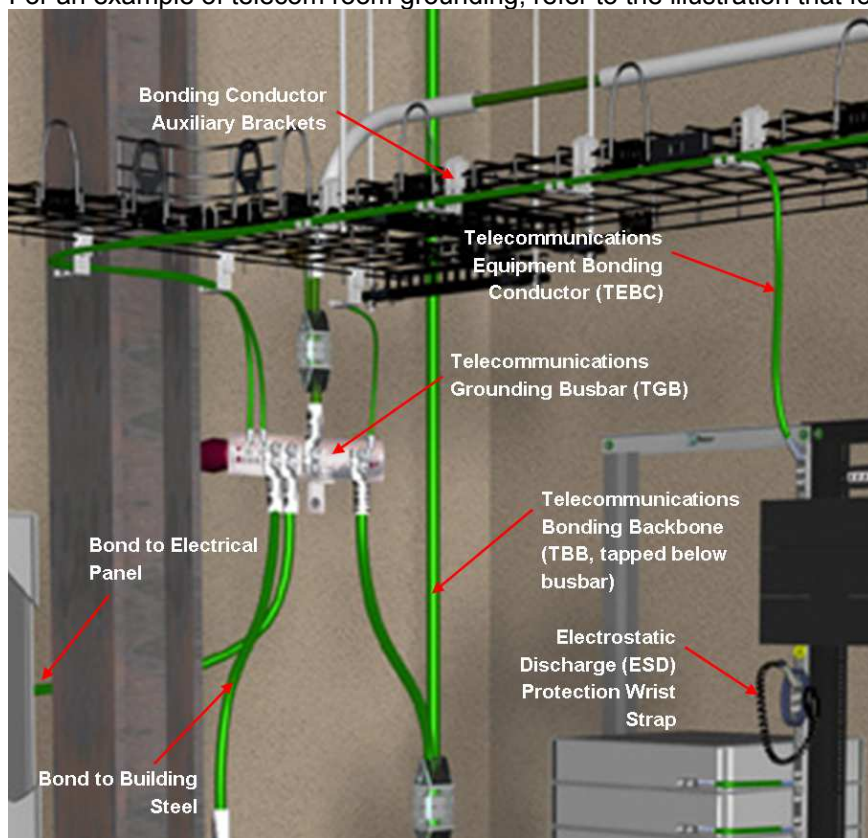
- [Attribute 1]
- [Attribute 2]

## 6. Distributor (Telecommunications) Rooms

- Within the telecommunications rooms and data centers all pathways and racks shall be grounded and bonded as indicated in the diagram below.
- Contractor is responsible for properly grounding all network equipment, racks and cabinets and bonding them to the wall mounted busbars as described in the TIA 607 series of standards.
- All newly installed racks and cabinets shall have installed a Panduit vertical strip mounted along one equipment rail to serve as a clean, low-resistance bonding place for equipment grounding jumpers used to bond equipment such as chassis switches, that come equipped with a designated grounding pad, back to the rack.

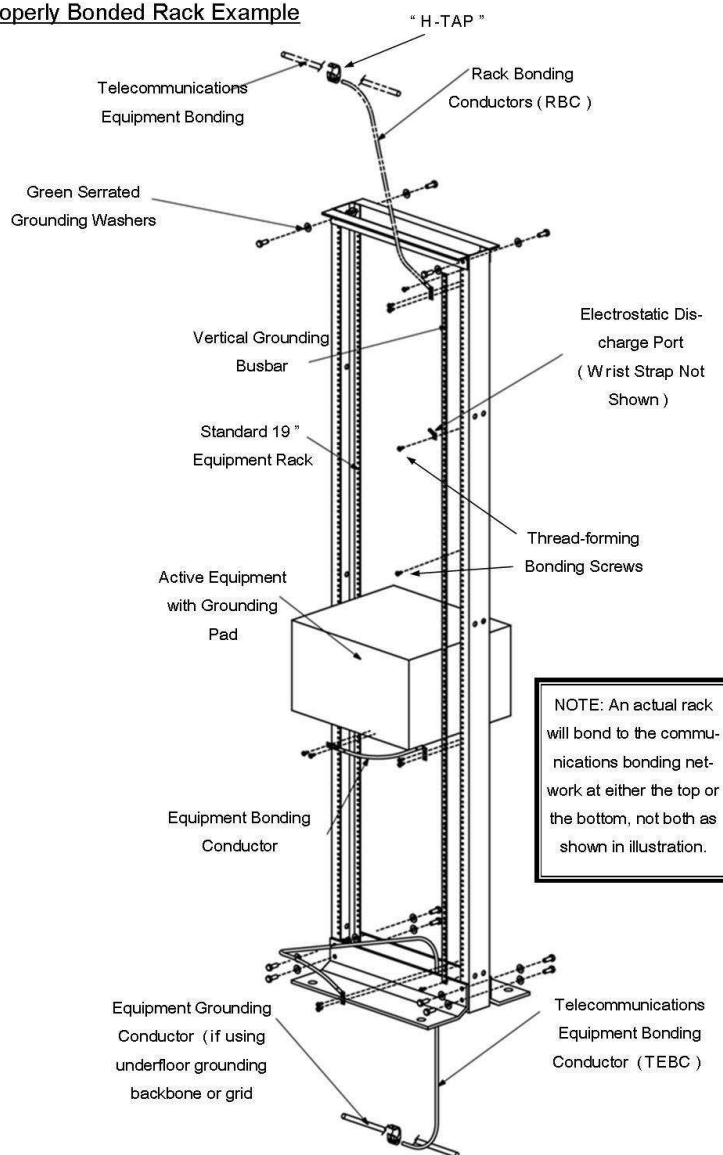
- d. Smaller equipment without an integrated grounding pad shall be bonded to the vertical busbar through the use of a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.
- e. Larger equipment (chassis switches) with a designated grounding terminal shall be bonded to the vertical busbar with an EBC (equipment bonding conductor) kit built to that purpose.
- f. Contractor shall take care to clean (wire brush, Scotch Brite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.
- g. All bonding lugs on racks and busbars shall be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and shall be removed and replaced at Contractor's expense.
- h. Every rack or cabinet shall have an individual bonding conductor into the grounding network, serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.
- i. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less.
- j. A minimum of every other rack or cabinet shall be outfitted with a properly installed and bonded ESD (electro-static discharge) port along with a wrist strap and lead to be used by any technicians servicing network equipment. On four post racks and cabinets these ESC ports and straps shall be provided on front and back to be accessible and able to reach any active equipment needing servicing.
- k. Armored cables shall be properly bonded to the earthing system on both ends with a kit built to that purpose.

- I. For an example of telecom room grounding, refer to the illustration that follows:

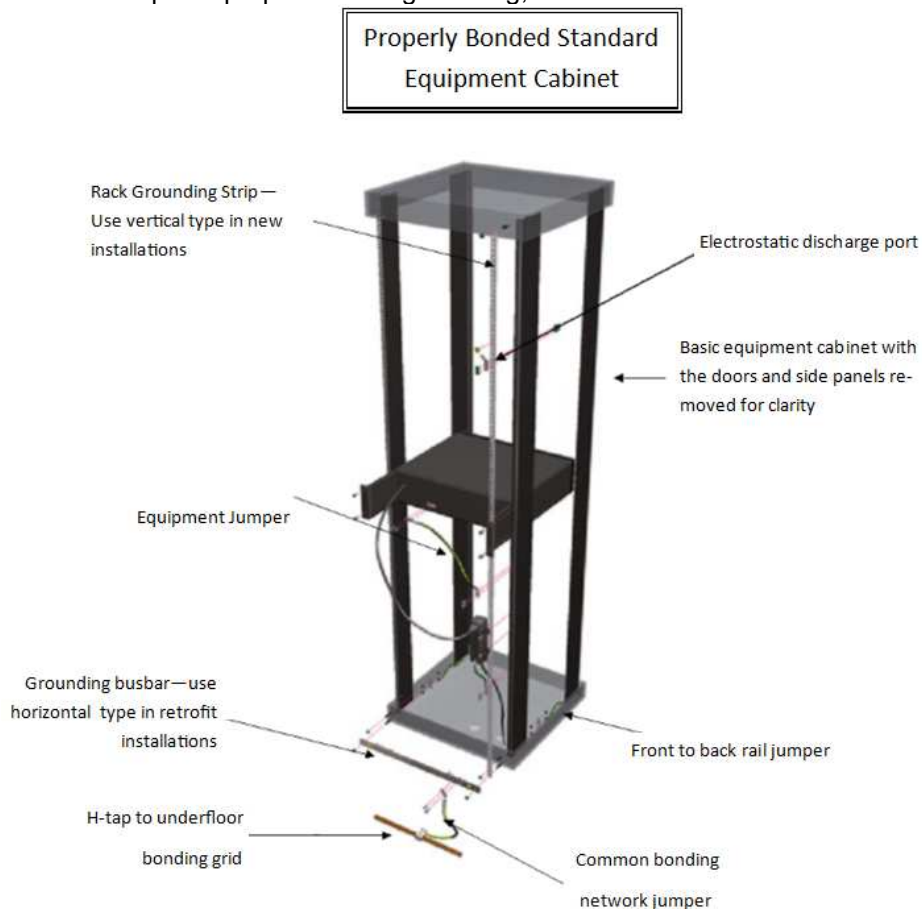


- m. For an example of proper rack grounding, see the illustration below:

Properly Bonded Rack Example



- n. For an example of proper cabinet grounding, see the illustration below:



## 7. Backbone Bonding Conductor (General Cable)

- a. Backbone bonding conductors (General Cable) for telecommunications shall have the following properties:
- [Attribute 1]
  - [Attribute 2]

## 8. Rack/Cabinet Grounding Hardware – RBC (Rack Bonding Conductor)

- a. Rack bonding conductors for telecommunications shall have the following properties:
- [Attribute 1]
  - [Attribute 2]

## 9. Rack/Cabinet Grounding Hardware – Clear Covers for H-taps (Optional)



- a. Rack bonding clear covers for H-taps shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 10. Rack/Cabinet Grounding Hardware – Electrostatic Discharge Kit

- a. Rack electrostatic discharge kits shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 11. Rack/Cabinet Grounding Hardware – ESD Wrist Strap for ESD Kit

- a. ESD wrist strap for ESD kit shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 12. Rack/Cabinet Grounding Hardware – Green Bonding Screws

- a. Green bonding screws shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 13. Rack/Cabinet Grounding Hardware – Green Bonding Cage Nuts

- a. Green bonding cage nuts shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 14. Rack/Cabinet Grounding Hardware – Thread Forming Screws

- a. Thread forming screws shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 15. Rack/Cabinet Grounding Hardware – Paint Piercing Grounding Washer Kit

- a. Paint piercing grounding washer kit shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 16. Rack/Cabinet Grounding Hardware – Unit Bonding Conductor (UBC)

- a. Unit bonding conductors shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 17. Grounding Busbars – Primary Bonding Busbar (PBB)

- a. Primary bonding busbar shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 18. Grounding Busbars – Secondary Bonding Busbar (SBB)

- a. Secondary bonding busbar shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 19. Grounding Busbars – Rack Bonding Busbar (RBB)

- a. Rack bonding busbar shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 20. Grounding Busbars – Rack Bonding Busbar (RBB) for 19" Horizontal (Retrofit)

- a. Rack bonding busbar for 19" horizontal (retrofits) shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 21. Grounding Busbars – Rack Bonding Busbar (RBB) – Vertical Busbar Strip (Threaded Rails)

- a. Rack bonding busbar for vertical busbar strip (threaded rails) shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 22. Grounding Busbars – Rack Bonding Busbar (RBB) – Vertical Busbar Strip (Cage Nut Rails)

- a. Rack bonding busbar for vertical busbar strip (cage nut rails) shall have the following properties:

- [Attribute 1]
- [Attribute 2]

#### 23. Other Bonding Hardware – Access Floor Grounding Clamps

- a. Access floor grounding clamps shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 24. Other Bonding Hardware – Surge Suppressor Jumpers

- a. Surge suppressor jumpers shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 25. Other Bonding Hardware – Armored Fiber Grounding Kit

- a. Armored fiber grounding kit shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 26. Other Bonding Hardware – Enclosure Grounding Kit

- a. Enclosure grounding kit shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 27. Other Bonding Hardware – Electrostatic Discharge Kit

- a. Electrostatic discharge kit shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 28. Other Bonding Hardware – ESD Wrist Strap for ESD Kit

- a. ESD wrist strap for ESD kit shall have the following properties:
  - [Attribute 1]
  - [Attribute 2]

#### 29. Other Bonding Hardware – Green Bonding Screws

- a. Green bonding screws shall have the following properties:

- [Attribute 1]
- [Attribute 2]

### 30. Other Bonding Hardware – Green Bonding Cage Nuts

- a. Green bonding cage nuts shall have the following properties:

- [Attribute 1]
- [Attribute 2]

### 31. Other Bonding Hardware – Thread Forming Screws

- a. Thread forming screws shall have the following properties:

- [Attribute 1]
- [Attribute 2]

### 32. Other Bonding Hardware – Paint Piercing Grounding Washer Kit

- a. Paint piercing grounding washer kit shall have the following properties:

- [Attribute 1]
- [Attribute 2]

### 33. Other Bonding Hardware – Retrofit Grounding Kits

- a. Retrofit grounding kits shall have the following properties:

- [Attribute 1]
- [Attribute 2]

### 34. Universal Beam Grounding Clamp

- a. Universal beam grounding clamps shall have the following properties:

- [Attribute 1]
- [Attribute 2]

## **F. Cable Pathways**

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1. See Appendix A for Part Numbers
2. Installation Guidelines

- a. Installation of cable pathways shall be compliant with most recent versions of all applicable standards, national and local codes, as well as the local Authority Having Jurisdiction (AHJ).
- b. Anywhere there is a conflict between standards, codes, installation specifications or project specific documentation contractor shall default to the most stringent.
- c. If further clarification is needed, contractor shall submit a written request for clarification to Niagara Regional Police Service. Response from Niagara Regional Police Service shall be in writing.

### 3. Wyr-Grid

- a. Metallic pathway shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 4. FiberRunner

- a. Plastic Fiber Duct shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 5. J-Hooks

- a. J-Hook system shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 6. J-Mod

- a. J-Mod system shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 7. J-Pro

- a. J-Pro system shall have the following attributes:
  - [Attribute 1]
  - [Attribute 2]

### 8. Surface Mount Raceway

- a. Surface mount raceway shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

## **G. Network Infrastructure Labeling**

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1. See Appendix A for Part Numbers
2. Installation Guidelines
  - a. Questions or comments regarding labeling strategies at Niagara Regional Police Service may be sent to Matt Kohut at Niagara Regional Police Service.
  - b. Contractor shall, wherever possible, pre-print labels using Panduit Easy-Mark software and desktop printer.
  - c. The Panduit PanTher (LS8E) hand-held thermal transfer printer shall be used onsite to print labels that were unanticipated, or that become damaged in application.
  - d. Labels shall be legible and placed in a position that insures ease of visibility.
  - e. All newly installed cables shall be labeled within 3 inches at both ends using a permanent self-laminating cable labels built to that purpose and designed to outlast the cable to which they attach.
  - f. Contractor is responsible for ordering the correct self-laminating cable labels appropriate to the cable outer diameter.
  - g. Each end of the cable shall have the same label.
  - h. The same identifier shall be contained in one line and repeated to be visible from all sides without having to rotate the cable to read it.
  - i. All labels shall be machine printed, bold font and centered at the highest point that can fit all characters legibly. Hand written labels will not be accepted and shall be remedied at Contractor's expense.
  - j. This labeling strategy shall, at a minimum, clearly identify all components of the system: racks, cables, panels and outlets, grounding, pathways and spaces like telecommunications rooms.
  - k. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.
  - l. All test documents shall accurately reflect the labeling scheme.
  - m. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
  - n. Machine-generated labels shall be installed behind the clear lens or cover on any device that provides such an option.
  - o. All labels will be permanently affixed to installed cables, patch panels, racks, cabinets, and enclosures.
  - p. Conduit shall be marked indicating the identification of the cable within.
  - q. Consult project specific documentation for the labeling scheme for a particular project.

### 3. Communication and Systems Elements Requiring Labeling

#### a. The following communications elements shall be labeled:

- Equipment outlets – faceplates
- Equipment outlets – surface boxes
- Copper horizontal cable
- Copper patch panels
- Communications patch cords
- Zone boxes (MUTOAs or consolidation points)
- Equipment racks
- Communications cabinets
- Telecommunications rooms – (closets)
- Fiber backbone cable
- Fiber enclosures
- Fiber optic patch cords (jumpers)

### 4. Other Systems Requiring Labeling

#### a. The following systems shall be labeled:

- Communications conduit and pathways
- Firestopping locations
- Grounding busbars
- Grounding backbone

### 5. Labeling Records

- a. Contractor shall provide a spreadsheet showing link records that list all labeled elements, including jack numbers, patch ports and telecom space identifiers.
- b. All labeling information shall be recorded on the as-built drawings, and cross-reference sheets as described in project documentation.

## **H. Cabling Accessories**

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### 1. Refer to Appendix A for Part Numbers

### 2. Plastic Cable Ties

- a. Plastic cable ties shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

### 3. Plastic Cable Ties – Plenum

- a. Plastic cable ties for plenum spaces shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

### 4. Elastomeric Cable Ties

- a. Elastomeric cable ties shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

### 5. Hook and Loop Ties

- a. Hook and loop ties shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

### 6. Hook and Loop Ties - Plenum

- a. Hook and loop ties for plenum spaces shall have the following attributes:

- [Attribute 1]
- [Attribute 2]

### 7. Physical Security Devices

- a. Some portions of Niagara Regional Police Service networks require additional physical security devices. These take three forms:
  - Devices that block-out copper and fiber ports in patch fields and faceplates that require a special tool for removal.
  - Devices that lock-in copper patch cords and require a special tool for removal of those patch cords.
  - Devices that temporarily or permanently block USB ports on laptops and computers.
- b. Areas where such devices are required will be called out in the project documentation.



<END OF SECTION>

## III. Testing and Acceptance

### A. General

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1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions.
2. All copper pairs or optical fibers of each installed cable shall be tested and verified prior to system acceptance.
3. Any defect in the cabling system performance or installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors or fibers in all cables installed.
4. All cables shall be tested in accordance with this document, the ANSI/TIA Standards, the Panduit warranty guidelines, and industry best 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.

### B. Copper Channel Testing

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1. All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA for the appropriate Category of cabling installed using a test unit meeting a minimum IEC IIIe level of accuracy.
2. All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is more stringent.
3. Contractor shall set references according to manufacturer's recommendation prior to each day's testing and reset references anytime the tester unit shuts down due to inactivity.
4. Resetting references shall also be done whenever test results become sporadic or the tester demonstrates a consistent deterioration of test measurement performance.
5. Testing of any links that include field-terminated plugs shall follow the procedure outlined in Panduit document #PN614, available from the Panduit representative, or downloadable from [www.panduit.com](http://www.panduit.com).

### C. Fiber Testing

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1. All installed fiber shall be tested for link-loss in accordance with ANSI/TIA standards cited in this document.
2. For horizontal cabling system using multimode optical fiber, attenuation should be measured in at least one direction, according to customer requirements, at either 850 nm (nanometer) or 1300 nm using an appropriate light source and power meter.
3. Fiber testing must be performed using reference grade test leads. Test results from tests using test leads that are not reference grade will not be accepted and must be retested at the Contractor's expense.

4. Backbone multimode fiber cabling should be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
5. Test set-up and performance shall be conducted in accordance the Method B (One Jumper Method).
6. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. Only basic link loss testing (OLTS) is required, not OTDR testing. OTDR testing is optional as a secondary test method but, by itself, is not a valid means by which links or channels can be certified.
7. The contractor can optionally install Panduit patch cords to complete the circuit and then test the entire channel, though Panduit currently issues only a link warranty, not a channel warranty. The test method shall be the same used for the test described above.
8. 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.
9. Qualification of the reference cords shall be completed after each reference and the insertion loss of the reference connectors shall be saved and presented as part of the testing documentation.
10. Panduit highly recommends utilizing the practice of individual end face inspection, cleaning if necessary then re-inspection before connecting any fiber end faces together in a link. This complete process should be performed BEFORE any OLTS testing takes place. For further process clarification, refer to Panduit Visual Inspection and Cleaning Best Practices #FS061.
11. Contractor shall further inspect, clean and re-inspect the Reference Lead connector end faces anytime testing shows inconsistent results. If this does not correct accuracy, contractor shall re-certify (test) the reference leads and replace them if necessary.

## **D. System Documentation**

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1. Documentation During Installation Phases
  - a. Niagara Regional Police Service will provide floor plans in paper and electronic (DWG, AutoCAD) 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 and returned to Niagara Regional Police Service.
  - b. 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. The Contractor shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD) form.
  - c. 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.

- d. It is mandatory that the test results from each phase be delivered in the tester native format. At the request of the Niagara Regional Police Service project lead, the telecommunications contractor shall provide copies of the original test results.
- e. 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.

## 2. Documentation at Project Completion

- a. A final, complete set of all documentation shall be provided in electronic format within three weeks after the completion of the project.
  - b. The testing results shall also be provided to Panduit in raw data format (native tester format), along with all associated warranty paperwork for evaluation and issuance of warranty.
  - c. All documentation shall be clearly marked with the words "Project Test Documentation" plus the project name, and the date of completion.
  - d. The test documentation shall detail the test methods used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
  - e. The test results shall further 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).
  - f. 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.
3. Unless the manufacturer specifies a more frequent calibration cycle, an annual factory calibration is mandatory on all test equipment used for the installation.
4. The project lead from Niagara Regional Police Service 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.
5. If retest findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Project Lead, including a 100% re-test. This re-test shall be at no additional cost to Niagara Regional Police Service.

## E. Inspection and Acceptance

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### 1. During Installation

- a. The Niagara Regional Police Service Project Lead will make periodic inspection of the project in progress.
- b. One inspection will be performed at the conclusion of cable pulling, prior to closing of the drop ceiling, to inspect the method of cable routing and support, and the firestopping of penetrations.

- c. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA recommendations for jacket removal and pair untwist, compliance with Manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

## 2. Final Inspection

- a. Upon completion of the project, the Niagara Regional Police Service Project Lead will perform a final inspection of the installed cabling system with the Contractor's project foreman.
- b. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the technical performance and aesthetic expectations of the Niagara Regional Police Service.

## 3. Live System Performance Verification

- a. During the three-week period between final inspection and delivery of the test and as-built documentation, Niagara Regional Police Service will activate and validate operation of the cabling system.

## 4. Final Acceptance

- a. Final acceptance is possible after completion of the installation, in-progress and final inspections, receipt of the test results, receipt of the as-built documentation, and receipt of the manufacturer's system performance warranty and successful performance of the system for a three-week period.
- b. Acceptance of the installed system by Niagara Regional Police Service must be in writing to be valid

## **F. Post Installation Maintenance Agreement**

---

- 1. The Contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of one year from the date of acceptance.
- 2. This rate will be used when cabling support is required to do moves, adds, and changes (MACs) to the system.
- 3. MACs shall not void the Contractor's nor Manufacturer's warranty.

<END OF SECTION>

## IV. Appendix A – Materials List

Product Category	Part Number	Manufacturer	Part Description
Copper Cabling Products	PUP6AV04*-G	Panduit	Copper Cable, Cat 6A, Vari-MaTriX, 4-Pair, 23 AWG, UTP, CMP, Blue, 1000ft/305m
	CJ6X88TG*	Panduit	The Category 6A, RJ45, 8-position, 8-wire, 10 Gb/s UTP Mini-Com® universal jack module has TG-style termination and is blue.
	CFPL2BLY	Panduit	Mini Com Classic series single gang vertical faceplate accepts two Mini-Com® Modules, includes label and label cover. Black
	CPPA48HDWBL	Panduit	Mini Com 48-port modular high density patch panel in black, (1RU).
	CPPA48HDWBL	Panduit	Mini Com 48-port modular high density angled patch panel in black, (1RU).
		Panduit	50um OM3 12 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers
Fiber Cabling Products	FODPX12Y	Panduit	50um OM3 12 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers
	FODPZ12Y	Panduit	50um OM4 12 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers
	FCE2U or FCE4U	Panduit	Holds up to eight or twelve (4U) QuickNet™ Cassettes, FAP adapter panels, or FOSM splice modules. Dimensions: 3.48"H x 17.60"W x 16.30"D (88.4mm x 447.0mm x 414.0mm)
	FAP12WAQDLC	Panduit	LC 10Gig™ OM3/OM4 FAP loaded with twelve LC 10Gig™ Duplex Multimode Fiber Optic Adapters (Aqua) with phosphor bronze split sleeves.
Racks, Cabinets, and Cable Management	N8512B	Panduit	Net-Access™ N-Type Cabinet frame with top panel. Tapped equipment rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2). Two sets of #12-24 threaded equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0in H x 31.5in W x 42.0in D (2134mm x 800mm x 1070mm). Color: Black, Two sets of SN25F fingers Included.

Product Category	Part Number	Manufacturer	Part Description
	<b>S8512B</b>	Panduit	Net-Access™ S-Type Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0in H x 31.5in W x 42.0in D (2160mm x 800mm x 1070mm). Color: Black
	<b>R2P6S</b>	Panduit	The Panduit Two-post Rack System provides a reliable foundation for mounting telecommunication and data center equipment.
<b>Bonding and Grounding</b>			
<b>Cable Pathways</b>			
<b>Network Labeling</b>			
<b>Other Cabling Accessories</b>			

&lt;END OF APPENDIX A&gt;

&lt;END OF DOCUMENT&gt;



PROVIDE ELECTRICAL VEHICAL CHARGING STATION.

# CT4000 Family

## ChargePoint® Networked Charging Station



## Installation Guide

ChargePoint, Inc.  
1692 Dell Ave.  
Campbell, CA 95008-6901 USA  
US toll free: +1-877-850-4562  
[www.chargepoint.com](http://www.chargepoint.com)

Document P/N: 75-001084-02 Rev. 3





# CT4000 Level 2 Commercial Charging Stations

## Specifications and Ordering Information

### Ordering Information

Specify model number followed by the applicable code(s).  
The order code sequence is: **Model-Options. Software, Services**  
and **Misc** are ordered as separate line items.

### Hardware

Description	Order Code
Model	
1830 mm (6') Single Port Bollard Mount	CT4011
1830 mm (6') Dual Port Bollard Mount	CT4021
1830 mm (6') Single Port Wall Mount	CT4013
1830 mm (6') Dual Port Wall Mount	CT4023
2440 mm (8') Dual Port Bollard Mount	CT4025
2440 mm (8') Dual Port Wall Mount	CT4027
Options	
Integral Gateway Modem - USA	-GW1
Integral Gateway Modem - Canada	-GW2
Misc	
Power Management Kit	CT4000-PMGMT
Bollard Concrete Mounting Kit	CT4001-CCM

### Software & Services

Description	Order Code
ChargePoint Commercial Service Plan	CTSW-SAS-COMM- <i>n</i> <sup>1</sup>
ChargePoint Service Provider Plan	CTSW-SAS-SP- <i>n</i> <sup>1</sup>
ChargePoint Assure	CT4000-ASSURE <sup>n</sup> <sup>2</sup>
Station Activation and Configuration	CPSUPPORT-ACTIVE
ChargePoint Station Installation and Validation	CT4000-INSTALLVALID

Note: All CT4000 stations come with 1 year of ChargePoint Assure coverage at no charge for qualified installations. Other conditions apply. All CT4000 stations require a network service plan.

<sup>1</sup> Substitute *n* for desired years of service (1, 2, 3, 4, or 5 years).

<sup>2</sup> Substitute *n* for the duration of the additional coverage (1, 2, 3, or 4 years).

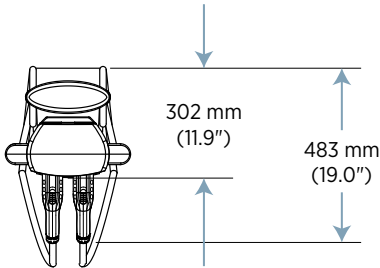
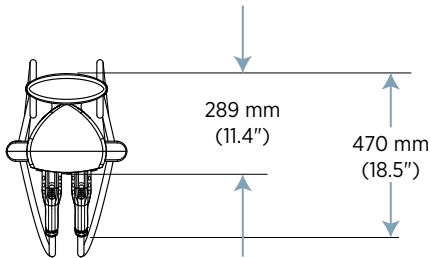
### Order Code Examples

If ordering this	the order code is
1830 mm (6') Dual Port Bollard USA Gateway Station with Concrete Mounting Kit	CT4021-GW1 CT4001-CCM
ChargePoint Commercial Service Plan, 3 Year Subscription	CTSW-SAS-COMM-3
ChargePoint Station Installation and Validation	CT4000-INSTALLVALID
2 Additional Years of Assure Coverage	CT4000-ASSURE2
1830 mm (6') Single Port Wall Mount Station	CT4013
ChargePoint Commercial Service Plan, 5 Year Subscription	CTSW-SAS-COMM-5
4 Additional Years of Assure Coverage	CT4000-ASSURE4
Station Activation and Configuration	CPSUPPORT-ACTIVE

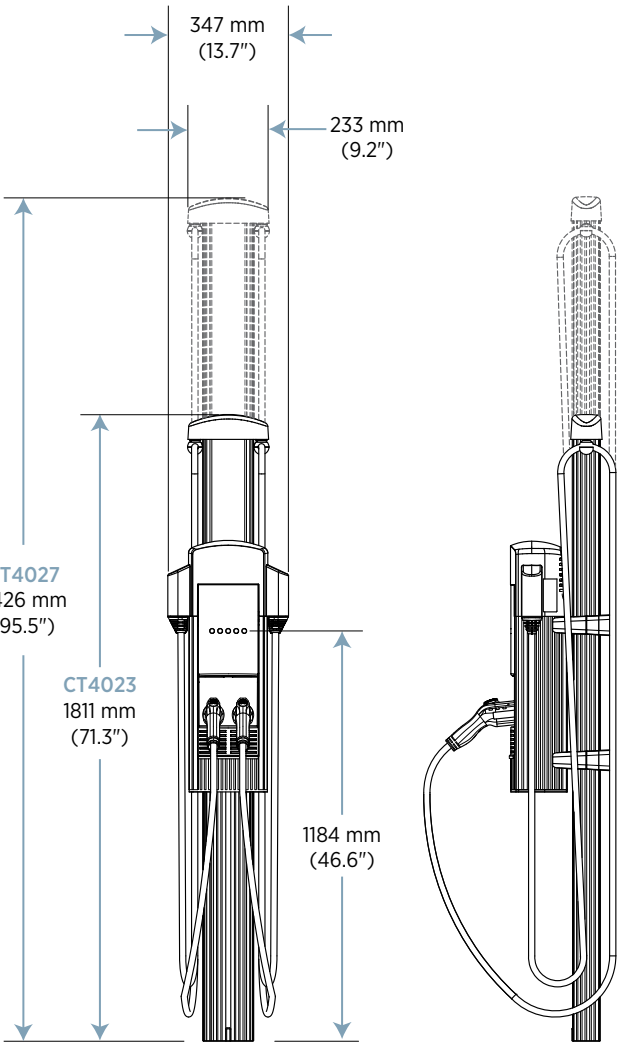
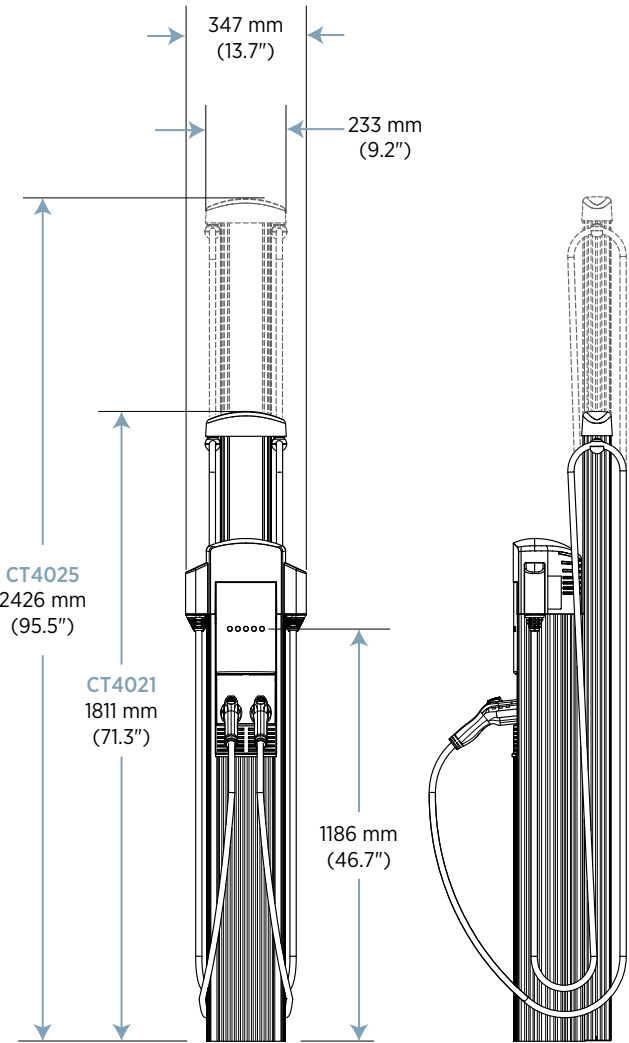


CT4021

**CT4021** 1830 mm (6')  
**CT4025** 2440 mm (8')  
**Bollard**



**CT4023** 1830 mm (6')  
**CT4027** 2440 mm (8')  
**Wall Mount**



## CT4000 Family Specifications

Electrical Input	Single Port (AC Voltage 208/240V AC)			Dual Port (AC Voltage 208/240V AC)		
	Input Current	Input Power Connection	Required Service Panel Breaker	input Current	Input Power Connection	Required Service Panel Breaker
Standard	30A	One 40A branch circuit	40A dual pole (non-GFCI type)	30A x 2	Two independent 40A branch circuits	40A dual pole (non-GFCI type) x 2
Standard Power Share	n/a	n/a	n/a	32A	One 40A branch circuit	40A dual pole (non-GFCI type)
Power Select 24A	24A	One 30A branch circuit	30A dual pole (non-GFCI type)	24A x 2	Two independent 30A branch circuits	30A dual pole (non-GFCI type) x 2
Power Select 24A Power Share	n/a	n/a	n/a	24A	One 30A branch circuit	30A dual pole (non-GFCI type)
Power Select 16A	16A	One 20A branch circuit	20A dual pole (non-GFCI type)	16A x 2	Two independent 20A branch circuits	20A dual pole (non-GFCI type) x 2
Power Select 16A Power Share	n/a	n/a	n/a	16A	One 20A branch circuit	20A dual pole (non-GFCI type)
Service Panel GFCI	Do not provide external GFCI as it may conflict with internal GFCI (CCID)					
Wiring - Standard	3-wire (L1, L2, Earth)			5-wire (L1, L1, L2, L2, Earth)		
Wiring - Power Share	n/a			3-wire (L1, L2, Earth)		
Station Power	8W typical (standby), 15W maximum (operation)					

## Electrical Output

Standard	7.2kW (240V AC @ 30A)	7.2kW (240V AC@30A) x 2
Standard Power Share	n/a	7.2kW (240V AC@30A) x 1 or 3.8kW (240V AC@16A) x 2
Power Select 24A	5.8kW (240V AC@24A)	5.8kW (240V AC@24A) x 2
Power Select 24A Power Share	n/a	5.8kW (240V AC@24A) x 1 or 2.9kW (240V AC@12A) x 2
Power Select 16A	3.8kW (240V AC@16A)	3.8kW (240V AC@16A) x 2
Power Select 24A Power Share	n/a	3.8kW (240V AC@16A) x 1 or 1.9kW (240V AC@8A) x 2

## Functional Interfaces

Connector(s) Type	SAE J1772™	SAE J1772™ x 2
Cable Length - 1830 mm (6') Cable Management	5.5 m (18')	5.5 m (18') x 2
Cable Length - 2440 mm (8') Cable Management	n/a	7 m (23')
Overhead Cable Management System	Yes	
LCD Display	145 mm (5.7") full color, 640x480, 30fps full motion video, active matrix, UV protected	
Card Reader	ISO 15693, ISO 14443, NFC	
Locking Holster	Yes	Yes x 2

## Safety and Connectivity Features

Ground Fault Detection	20mA CCID with auto retry
Open Safety Ground Detection	Continuously monitors presence of safety (green wire) ground connection
Plug-Out Detection	Power terminated per SAE J1772™ specifications
Power Measurement Accuracy	+/- 2% from 2% to full scale (30A)
Power Report/Store Interval	15 minute, aligned to hour
Local Area Network	2.4 GHz Wi-Fi (802.11 b/g/n)
Wide Area Network	3G GSM, 3G CDMA




## Safety and Operational Ratings

Enclosure Rating	Type 3R per UL 50E
Safety Compliance	UL listed for USA and cUL certified for Canada; complies with UL 2594, UL 2231-1, UL 2231-2, and NEC Article 625
Surge Protection	6kV @ 3000A. In geographic areas subject to frequent thunder storms, supplemental surge protection at the service panel is recommended.
EMC Compliance	FCC Part 15 Class A
Operating Temperature	-30°C to +50°C (-22°F to 122°F)
Storage Temperature	-30°C to +60°C (-22°F to 140°F)
Non-Operating Temperature	-40°C to +60°C (-40°F to 140°F)
Operating Humidity	Up to 85% @ +50°C (122°F) non-condensing
Non-Operating Humidity	Up to 95% @ +50°C (122°F) non-condensing
Terminal Block Temperature Rating	105°C (221°F)
Charging Stations per 802.11 Radio Group	Maximum of 10. Each station must be located within 45m (150') "line of sight" of a gateway station.

ChargePoint, Inc. reserves the right to alter product offerings and specifications at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

## Contact Us

To order your CT4000 charging station:

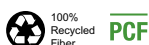
-  Visit [chargepoint.com/sales](https://chargepoint.com/sales)
-  Call +1.408.705.1992
-  Email [sales@chargepoint.com](mailto:sales@chargepoint.com)



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+1.408.841.4500 or toll free +1.877.370.3802  
[chargepoint.com](https://chargepoint.com)

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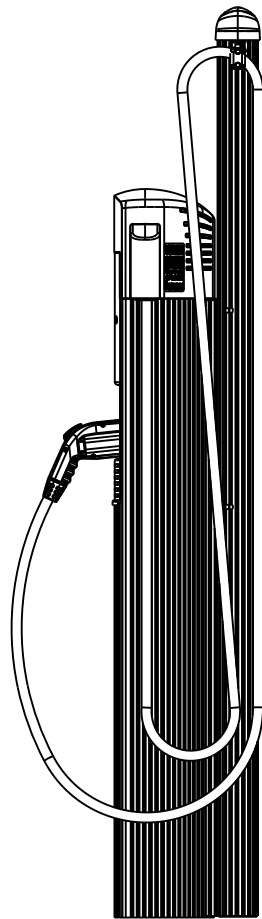
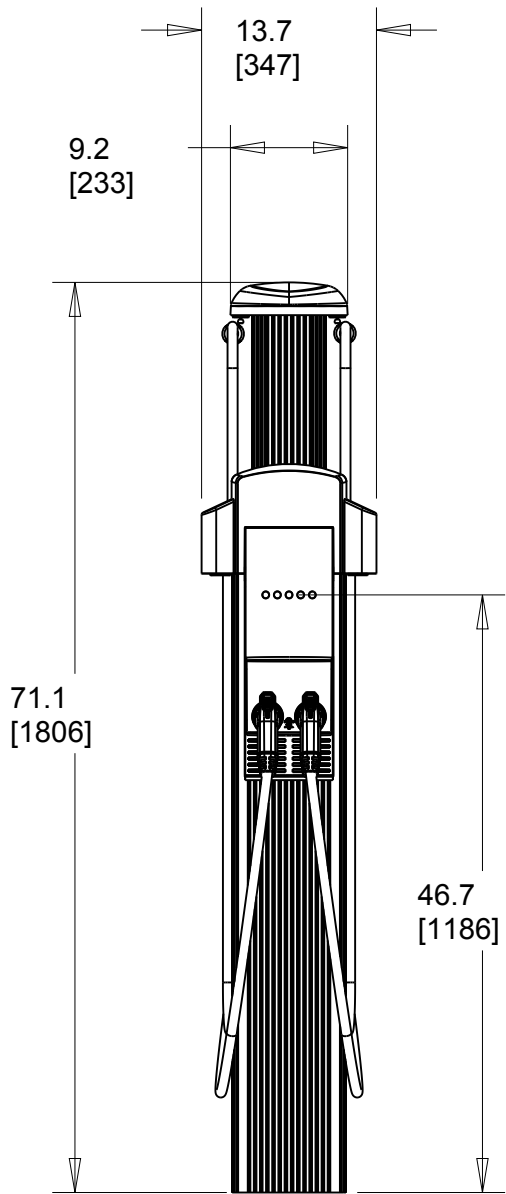
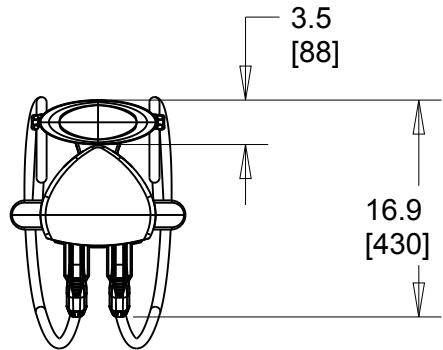
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Laboratories Inc. 

CT4021-CMK

SCALE 1:15



CONTRACTOR SCOPE RESPONSIBILITY SCHEDULE FOR IT							Project Number:
	Item	OWNER (Client)		CONTRACTOR			Last Revised: 11 June. 2018
		SUPPLY	INSTALL	SUPPLY (Procurement)	INSTALL	Test & Commission	REMARKS
1	Active Telecommunication Equipment	•			•	•	Free Issued to Contractor.
2	Fiber Backbone Cable run (Primary & Secondary)			•	•	•	Provide in conduit, Contractor May utilize existing conduit at his own discretion
3	Fiber run and fiber Patch Panels (OM4)			•	•	•	All fiber cabling shall be terminated in new fiber patch panels in each rack. Certified and labelled to TIA standards.
4	Fiber Patch Cords (OM4)			•	•	•	
5	RACKS			•	•	•	Provide four number of 19inch communication racks.
6	Data cabling (Cat 6A)			•	•	•	Termination and Testing at both ends.
7	Patch Panel (Cat 6A)			•	•	•	
8	Patch Cords at both ends (Cat 6A)			•	•	•	In addition to what is shown on drawing, provide 20% spare patch cords.
9	Phone Cabling (Cat 6A)			•	•	•	All Cat 6A cabling to be tested and verified to TIA standards
10	Access Points (Wifi / WAP) Cabling			•	•	•	
11	Deleted						
12	PCs, phones, printers	•	•				
13	CCTV, Access Control, Duress System			•	•	•	
14	TV	•			•	•	
15	Floor Boxes			•	•	•	
16	Tail Cables from Keystone at desk location for data and Voice. Each cable to be 5m length, and pretested.			•	•	•	In addition to what is shown on drawing, provide 20% spare patch cords.
17	JACK Labelling			•	•	•	Provide JACK Labelling schmatic diagram with the rack room
18	WAP			•	•	•	two 8-outlet power bars under each desk.
19	Audio Visual System						Provide conduits and power as required for AV ssytem; coordinaite with AV supplier.
							"smaller"-style keyboard trays installed. The team would like to standardize on the larger trays for the new desks.

# CONTRACTOR SCOPE RESPONSIBILITY SCHEDULE (CCTV)

**Project Number:**

	Item	OWNER (Client)			CONTRACTOR			REMARKS
		SUPPLY	INSTALL	PROGRAM	SUPPLY (Procurement)	INSTALL	Test & Commission	
1	Camera				•	•	•	work to be done by CCTV vendor as per cash allowance
2	Camera connection				•	•	•	
3	Data Outlet				•	•	•	Provide in conduit
4	conduits and junction box				•	•	•	
5	Active component				•	•	•	Coordinate site positioning and programming with client.
3	Patch Panels (CAT 6A)				•	•	•	
6	Data cabling (Cat 6A) from CCTV rack to Data outlet				•	•	•	Termination and Testing at both ends. Done by certified vendor.
8	Patch cable (CAT 6A)				•	•	•	
9	Camera Blackout						•	Coordinate with AV control programmer and Camera Vendor Technical Services for correct operation.
10	Outdoor CCTV Cameras				•	•	•	Provide fiber back bone cabling for distance exceeding 90m data service.
11	Outdoor Camera housing and heater				•	•	•	Provide electrical supply to camera heaters as required

CONTRACTOR SCOPE RESPONSIBILITY SCHEDULE FOR AV

Project Number:

	Item	OWNER (Client)		CONTRACTOR			REMARKS
		SUPPLY	INSTALL	SUPPLY (Procurement)	INSTALL	Test & Commission	
1	Active Telecommunication Equipment	•			•	•	Free Issued to Contractor.
2	Fiber Backbone Cable run (Primary & Secondary)			•	•	•	Provide in conduit, Contractor May utilize existing conduit at his own discretion
3	AV Rack			•	•	•	All fiber cabling shall be terminated in new fiber patch panels in each rack. Certified and labelled to TIA standards.
4	AV Active Componets	•	•				
5	AV patch cables			•	•	•	Provide four number of 19inch communication racks.
6	Data cabling (Cat 6A)			•	•	•	Termination and Testing at both ends.
7	Patch Panel (Cat 6A)			•	•	•	
8	AV Conduits			•	•	•	In addition to what is shown on drawing, provide 20% spare patch cords.
19	Audio Visual System						Provide conduits and power as required for AV ssytem; coordinaite with AV supplier.