

# York Region Information Technology Services

## Standards and Guidelines



### ITS Corporate Network Cabling Standard

**Current Published Version**

March 21, 2025

## Table of Contents

Document History .....	4
Revision & Schedule History .....	4
Change Summary .....	4
Additional Information .....	5
Contact .....	5
Consulted Organizations .....	6
Enforcement Language .....	6
Introduction .....	7
Background & Purpose .....	7
Network Equipment .....	7
Securing Network Devices on York Network .....	8
Objectives .....	9
Scope of Standard .....	9
Out of Scope .....	9
Education & Training .....	9
Authority, Exceptions and Exemptions .....	10
Structured Cabling Technical Specification .....	11
Recognized Media .....	11
Regulatory References & Standards .....	11
Documentation .....	13
Allowances .....	13
Waste Management & Disposal .....	13
Testing & Commissioning .....	13
Warranty .....	14
Site Walkthrough .....	14
Product Specifications .....	15
Backbone Cabling .....	15
Optical Cabling Backbone .....	15
Conduits .....	15
Backbone Interconnect .....	15
Termination Specification .....	15
Category Patch Panels .....	15
Fibre Patch Panels .....	16
Fibre Optic Cable .....	16
Connectivity .....	17

Category Patch Cord.....	17
Fibre Patch Cord .....	18
Communications Rack & Cabinet .....	18
Vertical Cable Managers.....	18
Overhead Cable Manager & Chimney.....	18
Equipment Shelves .....	19
Vertical Switched Zero PDU.....	19
General Enclosure Requirements.....	20
Enclosure Wiring.....	20
Rack/Cabinet Installation .....	21
Network Access Room.....	23
Environmental Specifications.....	23
Cable Access & Support .....	23
Property Services — Security Panel.....	24
Building Automation System (BAS) .....	24
Execution.....	28
Work Area Outlets.....	28
Horizontal Cable Installation .....	29
Fibre Optic Cable Installation .....	29
Appendix A — Horizontal Cable Labelling Format .....	31
Appendix B — Network Rack/Cabinet Layout (Single).....	32
Appendix C — Network Rack and Cabinet Layout (Dual Rack).....	33
Appendix D – Network CableTalk Cabinets.....	34
Appendix E — Network CableTalk 4-Post Open Frame Racks.....	36
Appendix F – Network Small Site Deployment Cabinets.....	37
Appendix G — Network Environmental Services Facilities NEMA4.....	38
Appendix H – HP Server Rack.....	39
Appendix I – Network CableTalk 2-Post Rack.....	40
Appendix J – Naming Convention for Wi-Fi Access Point (AP).....	41
Appendix K – Wireless Access Point (WAP) Installation & Mounting.....	42
Appendix L – Category Cabling Color Scheme for Services .....	43
Appendix M – Sample Matrix of Port Count Report.....	44
Appendix N – Network Closet Checklist for Standard Sites .....	45
Appendix O - WAN/ISP Duct Bank .....	46
Appendix P - WAN/ISP Ducts Inside Communication Room.....	47
References.....	48

## Document History

### Revision & Schedule History

Revision	Changed By	Last Reviewed	Review Scheduled
1.0	Simon Yates	March, 2012	
1.5	David Borsato	April, 2012	
1.6	David Borsato	June 25, 2014	
1.7	Orville Pitter	July 9, 2015	July 9, 2016
2.0	Orville Pitter	April 19, 2016	April 19, 2017
2.1	Orville Pitter	July 28, 2016	April, 2017
2.2	Orville Pitter	Jun 22, 2017	April, 2018
2.3	Orville Pitter	May 9, 2018	April, 2019
2.4	Orville Pitter	June 28, 2018	April, 2019
2.5	Orville Pitter	January 22, 2019	April, 2020
2.6	Orville Pitter	December 19, 2020	April, 2021
2.7	Simon Yates	March 25, 2020	April, 2021
2.8	Orville Pitter	April 21, 2020	April, 2021
2.9	Orville Pitter	July 6, 2020	July, 2021
2.10	Orville Pitter	September 15, 2020	September, 2021
2.11	Orville Pitter	November 16, 2020	March, 2022
2.12	Orville Pitter	March 1, 2021	March, 2022
3.1	Orville Pitter	June 21, 2021	March, 2022
3.2	Orville Pitter	February 8, 2022	March, 2022
3.3	Orville Pitter	February 3, 2023	March, 2023
3.4	Orville Pitter	May 12, 2023	March, 2024
3.5	Orville Pitter	June 18, 2024	March, 2025
4.0	Orville Pitter	February 7, 2025	March, 2026

### Change Summary

Date	Summary
July 28, 2016	Minor grammar and syntax updates. Fax Lines Requirement – Deleted. Appendix D & E updated.
January 9, 2017	Replaced must with shall, and added Document Changes table to document history.
August 28, 2017	Changed cabling 6A to 6A F/UTP.
April 24, 2018	Changed in-building renovations in scope, multimode optical fibre to OM4, added appendix B, changed BAS, Security Panel (Honeywell), rack cabinet installation, and applied new corporate writing style.
May 9, 2018	Updated contact information.
June 28, 2018	Added Appendix K.
January 22, 2019	Updated technical specifications.
December 19, 2019	Renamed from Cabling and Wiring for Voice and Data Communications to Corporate ITS Cabling & Wiring Standard. Updated network equipment.
March 25, 2020	Formatting, grammar, spelling updates.
April 21, 2020	Updated Appendix 2, and general requirements for network equipment.

July 9, 2020	Updated network devices on York Networks, category patch cords, and vertical cable managers.
September 14, 2020	Minor grammar and syntax updates. Removed duplicate heading product specifications n page 18. Promoted second and first level heading, fibre optical cable page 20. Added Appendix L – WAP/Mounting.
November 9, 2020	Updated appendices H with cable talk 2 post rack; M with WAN/ISP duct bank; N with WAN/ISP ducts inside communications room; updated network equipment; and updated communication rack and cabinet.
March 1, 2021	Background & Purpose, Network Devices on York Network, updated to Securing Network Devices on York Network,c, d, and e added. Technical Specifications, updated to Structured Cabling Technical Specifications Termination Hardware, updated to Termination Specification Horizontal Cables, updated to Category Patch Panels Fibre Optic Cable, Connectors moved to section Termination Specification PS Security section updated Enclosure Wiring, changed to Labeling Guidelines Update: Property Services – Security Panel, Building Automation System (BAS)
April 12, 2021	Minor update and changes.
June 28, 2021	The following has sections that have been modified, relocated or deleted: Enforcement Language; Background and Purpose, Contact, Objectives, Scope; Structured Cabling Technical Specification, Recognized Media, Regulatory References & Standards, Waste Management & Disposal, Testing & Commissioning; Product Specification, Backbone Cabling, Conduits, Backbone Interconnect, Fibre Optic Cable, Fibre Optic Connectors, Category Patch Cord; Network Access Closet has been changed to Network Access Room; Execution, Horizontal Cable Installation, Fibre Optic Cable Installation; Appendix; References
July 21, 2021	Further changes to grammar, syntax and tightening of language through the standard.
February 8, 2022	Minor spelling, grammar changes.
February 6, 2023	Updates to the following sections: Site Walk through; Telecom Contractor to provide port count; Structural Cabling Technical Cabling update to include end-to-end by specified color and single contractor for cabling; Cabinets for small deployment and for ENV NEMA4 inserted Appendix F, Category Cabling Color Scheme for Services inserted Appendix L; Sample Matrix of Port Count Report inserted Appendix M; Network Closet Checklist for Standard Sites inserted Appendix N, and remaining adjusted accordingly;
May 12, 2023	Added wall mount cabinet to Appendix D; updated Appendix K, and changed underscore to hyphen.
June 18, 2024	Updates to the Environmental section #3.; Appendix G: removed Hammond and replace with Hoffman Cabinet; and updated the URL in Appendix E.
March 21, 2025	Appendix A, update data drop format; NAC Floor finish epoxy; Patch cable gauge from 26 to 28; correct grammar; change name of file/document to reflect name on title page.

## Additional Information

Enterprise Architecture manages annual reviews and promotion of the standard.

## Contact

This standard is updated frequently. Contact the person below to ensure that you have the most recent version of this document.

Orville Pitter, Senior Network Analyst, Infrastructure, Planning & Operations  
orville.pitter@york.ca

## Consulted Organizations

The following individuals and groups were consulted in the formation of this standard.

Organization Consulted	Division	Branch	Date
Ministry of Government Services	Infrastructure Technology Services	Corporate Architecture Branch	April 2011
Belden			May 18, 2021

Committee or Working Group Consulted	Date
Enterprise Architecture	March 2012
Infrastructure and Operations	March 22, 2011
ITS Branch Review	April, 2012

## Enforcement Language

The meaning of the words shall or should or must and recommend are clearly define here:

- Shall: this word, or the terms required or must, means that the statement is an absolute requirement.
- Should: this word, or the adjective recommended, means that there may exist valid reasons in particular circumstances to ignore the recommendations, but the full implications must be understood and carefully weighed.
- Exception: An exception refers to a specific case where a standard does not apply, even though the general rule remains in effect for all other cases. Exceptions are often temporary.
- Exemption: An exemption is the complete release from the standard for specific individuals, groups, or circumstances. An exemption is more permanent and grants full freedom from compliance with a particular rule or requirement.

Cabling and its installation shall comply with the requirements of the authority having jurisdiction (AHJ) and applicable regulations. This includes, but is not limited to, the cabling jacket ratings.

## Introduction

### Background & Purpose

This standard defines the design minimum technical and quality requirements for wiring of voice and data communications rooms in all buildings that are managed by, or on behalf of The Regional Municipality of York.

This standard includes new developments, revisions, and updates in cabling plant such as Power over Ethernet (PoE) data centre specific standards, cabling for wireless access points, digital signage, security, and other operational technologies (O/T) that use structured cabling for their infrastructure and the administration standard for cabling plant management. Four topic areas include.

1. **Data centres that are managed by or on behalf of the Regional Municipality of York.** Data centres are included to provide requirements and guidelines for the data centre design and installation. These requirements and guidance are found in ANSI/TIA-942: Telecommunications Infrastructure Standard for Data Centres.
2. **The Cabling of buildings for wireless access points.** Provides requirements and guidelines on the installation of a customer premises cabling system infrastructure for an array of coverage areas that form a wireless network grid within a building. These requirements and guidelines are found in TIA TSB-162: Telecommunications Cabling Guidelines for Wireless Access Points.
3. **Specific adherence to the IEEE 802.3 standards** provides for the implementation of power over Ethernet or data lines within the plant owned by, or managed on behalf of the Regional Municipality of York.
4. Specifies a uniform administration approach to the management of a telecommunications cabling system as found in ANSI/TIA -606: Administration Standard for Telecommunications Infrastructure.

This standard applies to all new or major retrofit wiring of data and voice communications in existing Regional Municipality of York buildings.

### Network Equipment

1. Project will provide the budget for all network equipment including network switches, wireless access points, wireless controller, uninterrupted power supply, firewalls and any other network equipment that ITS considers mandatory to support the setup and configuration the network to meet ITS standards.
2. ITS will procure all network equipment including network switches, wireless access points, wireless controller, uninterrupted power supply, firewalls and any other network

equipment that ITS considers mandatory to support the setup and configuration of the network to meet ITS standards based on the budget.

3. Telecom contractor shall supply network racks, cables, patch panels, cable trays and any associated supplies for cabling based on ITS Cabling and Wiring Standards.
4. Telecom contractor shall provide port count by network closet and by device type (data/voice, WAP, BAS, Energy, Camera, IoT) to enable Corporate ITS requested quotes for network equipment and to assign IP-addresses (see Appendix M).
5. Telecom contractor shall provide any emulated Wi-Fi surveys with input, review and acceptance for Corporate ITS.
6. Telecom shall install racks, run network cables and terminate to patch panels, install UPS and WAPs based on instructions provided by Corporate ITS.
7. Backbone and horizontal infrastructure cabling shall be completed by an installer certified by the cabling system manufacturer, and the cabling shall be certified upon completion.
8. ITS recommends that category cable patch panels be from manufacturers that meets or exceeds ANSI/TIA 568.2 Category 6A performance requirements and design specifications.

## **Securing Network Devices on York Network**

1. All devices that require connectivity to York Networks shall be direct network run.
2. A list of all devices not issued by York ITS that will connect to the York Network must be provided to Corporate ITS. The list must include the make, model and specification and function.
3. ITS Security must conduct ITS security testing on all devices prior to connection to the York Region Network.
4. If testing of device is not done prior to connection, then it is done when the first device is added to the network.
5. If York ITS identifies security issues, these issues need to be resolved by the vendor.
6. ITS Security and Enterprise Architecture will review and make recommendations as well as provide a path to ensure that the device is a safe device to be on the York Region network.

## Objectives

The Objectives of this standard are to:

1. Provide safe, reliable, uniform and up to date facilities for the convenient connection of telephones, computers, computer terminals and other communications related technologies utilizing cabling and wiring in Regional offices.
2. Achieve significant cost savings in the rearrangement of government offices and the relocation of government services and personnel by uniform and flexibly arranged communications connections.
3. Increase the value of the investment in the cabling infrastructure by reducing the labour expense of maintaining the system, extending the useful life of the system and providing effective service to users.

## Scope of Standard

The following platforms, and facilities are in scope of this standard.

1. Horizontal and vertical structured cabling platforms
2. Data centre structured cabling platforms
3. In-building facilities including
  - a. Main telecommunications room
  - b. Telecommunications rooms
  - c. Workstations
4. In-building renovations
  - a. If cabling is less than Category 6 standard or older than 10 years, must be replaced with current standard including the patch panel and all related connectivity.

## Out of Scope

Electrical cabling is not covered by this standard.

## Education & Training

Data Centre and technical staff shall be trained and experienced on the technologies used pertaining to structure cabling infrastructure.

# ITS Corporate Network Cabling Standard

eDOCS: 5708119

**First published:** July 9, 2012  
**Scheduled review:** Annual  
**Last updated:** March 21, 2025  
**Last Reviewed:** March 21, 2025  
**Approved by:** TSB

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## **Authority, Exceptions and Exemptions**

Any change, exception, exemption or deviation from this standard shall be reviewed by the Region's Strategy & Architecture, Technology Planning units and approved by the Technology Standards Working Group (TSWG). Any change to this standard shall be submitted to the TSWG.

## Structured Cabling Technical Specification

1. The contractor shall provide a complete and operating Structured Cabling Platform to support existing and future communication systems in Regional facilities. This includes all horizontal cabling for data applications as well as backbone.
2. All cabling for the network shall be completed by one cabling contractor that is able to provide cable as built and test results.
3. Network (horizontal) cabling shall adhere to York ITS Network Standard Category cabling color specification and installed end-to-end including keystone and patch cables.
4. If product specifications, design and installation guidelines are not provided or in conflict with references listed below. The more stringent requirement shall apply.
5. The Horizontal Structured Cabling Platform installed shall meet or exceed the channel requirements for voice and data transmissions as defined by ANSI/TIA-568.2.
6. Any Structured Cabling Platform installed in a Data Centre or Communications Room shall follow the mandatory requirements, guidelines and best practices for data centre cabling systems, pathways and design considerations found in Regulatory References and Standards: Telecommunications Infrastructure Standard for Data Centres.
7. Category 6A UTP (500MHz) 23AWG cabling shall be used as the minimum rated twisted pair cable. Horizontal cabling should be installed point-to-point, no network consolidation point.
8. Cables, associated connecting hardware, jumpers, patch cords, equipment cords and zone area cords shall meet all applicable requirements specified in ANSI/TIA-568.2.2 and ANSI/TIA-568.3.

## Recognized Media

1. 100 ohm twisted-pair cable, ANSI/TIA-568.2, Category 6A UTP 23AWG.
2. Patch cables of minimum Category 6A F/UTP 28AWG.
3. Multimode optical fibre cable OM4, ANSI/TIA-568.3.
4. Single-mode optical fibre cable, ANSI/TIA-568.3.

## Regulatory References & Standards

The standard defines specific categories of cabling, components, transmission performance, system models, and measurement procedures. These are needed for verification of cabling performance that shall be used at a minimum for any new or major retrofit wiring of data and voice communications in existing York Region buildings. These are the requirements found in recognized telecommunications industry standards:

## **Cabling Systems**

1. ANSI/TIA-568-C.0: Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA-568.1: Commercial Building Telecommunications Infrastructure Standard
3. ANSI/TIA-568.2: Balanced Twisted Pair Telecommunications Cabling and Components Standard
4. ANSI/TIA-568.3: Optical Fibre Cabling and Component Standard

## **Spaces and Pathways**

5. ANSI/TIA-569: Telecommunications Pathways and Spaces.

## **Cabling Administration**

6. ANSI/TIA606: Administration Standard for Telecommunications Infrastructure.

## **Telecommunications Infrastructure Standard for Industrial Premises**

7. ANSI/TIA-1005: Telecommunications Infrastructure for Industrial Premises.

## **Telecommunications Infrastructure Standard for Data Centers**

8. ANSI/TIA-942: Telecommunications Infrastructure Standard for Data Centres.

## **Wireless Access Points**

9. TIA TSB-162: Telecommunications Cabling Guidelines for Wireless Access Points

In addition, coverage of this standard includes new developments and updates in cabling plant such as Power Over Ethernet (PoE) data centre specific standards, cabling for wireless access points and the administration standard for cabling plant management.

All work shall conform to industry accepted practices, manufacturer's component installation guidelines, the Ontario building code, the Canadian Electrical Code, and all applicable standards. The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies. Furthermore, compliance with the AHJ will supersede all other specifications.

This standard applies to all new or major retrofit wiring of data and voice communications in existing Regional Municipality of York buildings.

## Documentation

Documentation related to the installation, maintenance and disposal of cabling plant shall be created and maintained by the parties responsible for installing and maintaining the cabling infrastructure on behalf of the Regional Municipality of York. This administration of the cabling plant is governed by the mandatory use of Standard Update to Administration for the telecommunications infrastructure; and the labelling convention described in Regulatory References and Standards under Cabling Administration.

The following line items describe individual requirements that are to be applied to all Communications Cabling projects. The line items are meant to serve as a guideline for the Regional requirements.

All horizontal cabling shall be installed from the workstation location, or on modular patch panels installed into racks or cabinets. For small sites, the customer can specify wall-mounted patch panels in lieu of racks where appropriate due to site constraints and capacity requirements.

## Allowances

Devices, racks, cabinets, backboards or outlets may be relocated, prior to installation, from the location shown on the contract drawings, to a maximum distance of 3.05 meters (10 feet) without adjustment to the contract price.

## Waste Management & Disposal

1. The cabling contractor shall remove and dispose of all abandoned horizontal voice, data and coaxial cabling.
2. If the cabling contractor is unsure of the status of the cables, they shall confirm the removal with the project manager prior to performing the work.

## Testing & Commissioning

1. Provide two copies of testing and commissioning documentation for all items and their related components to the project manager prior to the completion of the project or at the project manager's request.
2. Include maintenance manuals, operating instructions for the Region's staff.
3. All test data, including daily equipment reference checks, shall be submitted in native tester format (e.g. FLW files for Fluke) and summary in PDF.

## Warranty

1. The contractor shall provide a complete and operating Structured Cabling Platform to support existing and future communication systems in Regional facilities. This includes all horizontal cabling for data applications as well as backbone.
2. The structure cabling platform in each individual building or site shall be manufactured and warranted by a single manufacturer for all components of the structured cabling platform including backbones.
3. The successful bidder shall install a complete structured cabling platform that is manufactured and warranted by a single vendor.
4. The successful bidder shall be authorized by the cable vendor to install and warranty the system.
5. If a sub-contractor is used for the installation, it is mandatory that the sub-contractor be currently authorized to install and warranty the system.

## Site Walkthrough

The cabling contractor shall participate in network cabling walkthroughs:

1. 0% walkthrough: Initial pre-construction walkthrough with ITS, York Region and General Contractor (GC) to ensure that the scope of work is understood and for questions regarding ITS Network cabling standards.
2. 50% walkthrough: to confirm the project is on track and the cabling standards are adhered to.
3. 100% walkthrough: for the network closet acceptance (cabling is completed, Network closet is free of all debris, testing results and has builds have been provided, etc) with ITS, York Region, GC and cabling contractor. The acceptance is contingent on satisfying the criteria outlined in "ITS New/Renovated Site Networking Provisioning Checklist" (Appendix N).

## Product Specifications

### Backbone Cabling

#### Optical Cabling Backbone

1. OM4 fibre backbone cabling shall comply to ANSI/TIA-568.3.
2. Each Fibre backbone cable shall have a minimum of 12 strands OM4 distribution type fibre. The OM4 distribution type fibre will perform as per industry standards over the required distance defined for the site. Mated connector loss for OM4 shall not to exceed 0.25 dB.

#### Conduits

1. Conduit fill ratios shall never exceed the recommendations of ANSI/TIA-569.

#### Backbone Interconnect

1. If there is a requirement for an interconnection between wiring closets on the same floor, or multiple floors, it shall be interconnected with minimum of six fibre OM4 rated fibre optic backbone terminated with LC connectors.
2. All connectors for the termination of the fibre optic backbone cable shall be duplex LC connectors.
3. Fibre optic enclosure shall meet the following requirements:
  - a. Enclosure shall include a slide-out drawer for front access of the terminations.
  - b. Enclosure shall support LC connectors.
4. For multimode fibre optic terminations inside access closets fibre patch panels the connectors shall be preloaded adapters configured with LC duplex multimode adapters.
5. Provide duplex OM4 fibre optic patch cables LC to LC.

## Termination Specification

### Category Patch Panels

5. All horizontal cables are to be terminated on RJ45 jacks, inserted into modular category patch panels, and placed in the telecommunications room for that floor.
6. The modular patch panel should minimise the rack space used and should not exceed two rack units in height.

## Fibre Patch Panels

1. If required, the number of strands to be supplied and installed is a minimum of 12. The project manager, in consultation with the Region, will finalize quantity and type of fibre to be installed.
2. All Fibre backbone is to be terminated using a fibre patch panel on a communications rack.
  - a. The 12 strands of fibre shall be installed in the fibre patch panel and placed in a rack in the telecommunications room for that floor.
  - b. The fibre patch panel should minimize the rack space used, it cannot exceed three rack units in height.
  - c. The fibre patch panel shall be serviceable from the front by allowing the fibre patch panel to slide or pivot away from the rack.
  - d. The fibre patch panels are to be mounted at the upper most position on the racks of each floor.
3. Provide all necessary accessories for a complete fibre patch panel including, but not limited to: clear cover plates, mounting brackets and hardware, LC duplex fibre bulkheads, LC connectors and fibre cable management.
4. The physical fibre optic cabling topology and the type of fibre connectors shall be determined and finalized during design build of project.

## Fibre Optic Cable

1. Provide all fibre optic cable, connectors and appurtenances that make up the backbone cable segments.
2. The fibre optic backbone cable segments shall meet the requirements of the TIA/EIA-568.3 specifications.
3. Multi-mode fibre optic backbone cable shall be OM4.
4. Single mode fibre optic backbone cable shall be OS2.

## Connectivity

### Category Patch Cord

1. Three patch cords seven feet in length per drop shall be provided on site, two for the IP phone/desktop connectivity, and one for the patch panel to network switch.
  - a. These cords shall match the cabling category being installed. Further small OD patch cords shall be used where the performance of the network will not be negatively affected: i.e. channel length and configuration, data transmission and power delivery.
2. The project manager, in conjunction with the ITS planner and Network Operations, shall determine the fibre and category patch cable length as needed.

## **Fibre Patch Cord**

1. All fibre patch cords shall be connected to the customer supplied active equipment using LC duplex zip cords.
2. The fibre patch cords are to be seven feet in length. LC duplex zip cords are to be consistent with the grade and manufacturer of the fibre cable that is being warranted.

## **Communications Rack & Cabinet**

1. All racks and cabinets to be supplied and installed to be bolted to the floor or otherwise secured to prevent tipping, 19" floor mounted with 44U of rack mounting space.
  - a. Racks and cabinets shall be tapped both front and back with mounting holes as per EIA-310-C, size 10-32, as well as include a ground lug to accept a #6 AWG grounding wire.
2. All network access spaces dedicated to York Region ITS network and Security should utilize 2-Post open frame rack (see Appendix H).
  - a. If other services beyond ITS Network/Security is to be hosted, types of rack/cabinet installation should be discussed and determined by York Region IT Services.

## **Vertical Cable Managers**

1. Network cabinet shall come complete with two vertical cable managers installed: one mounted on each side.
2. Network rack cable managers shall be one of two dimensions. Micro and small sites four inches wide by four inches deep.
3. Medium and large sites 7.5 inches width by six inches deep.
4. The vertical cable manager shall have hinged front door(s), back and side cut outs to allow for patch cords.
  - a. It shall also have lancets along the back of the cable manager to allow for the fastening of the horizontal cable to the outside of the manager itself.
  - b. Higher density drops may require vertical cable management with increased width and depth.

## **Overhead Cable Manager & Chimney**

1. Each cabinet and rack shall come complete with a hinged overhead cable manager installed, with minimum dimensions of eight inches wide by two inches deep.
  - a. Where racks are ganged, the overhead cable manager is to be continuous across the gang of racks; both ends of the ganged racks are to be completed with end caps.

2. At the right side of each rack a cable management chimney shall be installed. They shall extend from the top of the overhead cable manager to the underside of the ladder tray/ceiling tile above.

## **Equipment Shelves**

1. Each cabinet and rack is to be supplied with, at a minimum, one equipment shelf if requested; this is to be installed at the direction of the customer.
2. The equipment shelf shall be centre mounted and have a minimum of 18 inches of depth.

## **Vertical Switched Zero PDU**

1. Each cabinet and rack is to come complete with two vertical switched Zero U PDU mounted to the back of the rack.
2. Each PDU is to have a minimum of eight outlets rated at 110V, 15A. The power bars are to have a minimum power cord length of six feet.
3. The power bars shall not have reset breakers or an on/off switch.
4. The Customer may require additional power requirements over and above what is detailed above. It is the responsibility of the Project Manager to provide these requirements to the Cabling Contractor.

## General Enclosure Requirements

1. All indoor enclosures containing network components are to be installed in a two-post, four-post open rack frame, or cabinet.
2. All screws, bolts, fasteners etc. are to be corrosion resistant stainless steel.
3. All wall-mounted panels are to be separated from the wall by stainless steel spacers or galvanised steel struts.
4. Doors shall have continuous hinges with removable pin and oil resistance cellular neoprene gasket secured by gasket retainers.
5. Door handles shall be recessed type (freestanding enclosures) or three-point external latch wall mount, complete with key locks. All key locks are to be identically keyed. The key number shall be provided to the Contractor during construction.
6. Cable bundles shall be neatly laced, run in ducting or approved cable managers and secured to 19-inch rack or mounting back-panel.
7. All enclosure doors shall open through 180 degrees without restriction.
8. Enclosure layout and equipment spacing shall be constructed to allow for device removal, calibration and maintenance without disassembly of adjacent devices.
9. All freestanding, floor-mounted enclosures shall have removable CSA eyebolts to facilitate sling handling of each enclosure.
  - a. Eyebolt mounting shall be a part of the structural support bracing to distribute stresses and enclosure weight while sling handling enclosures during installation.
10. All enclosures shall have sufficient structural reinforcements to ensure a limited plane surface vibration and to provide rigidity during shipment, installation and operation without distortion or damage to the enclosure, mounting panel or mounted instruments.
11. All enclosure seams shall be continuously welded and ground smooth to be undetectable after painting.
12. Devices shall be installed on the enclosure back-panel or 19-inch rack.
13. There shall be no devices installed on the side plates of the enclosure.

## Enclosure Wiring

1. All enclosure wiring shall run through cable management. All cabling is managed, protected, and enclosed.
2. Cable managers shall not be filled to more than 50 percent of their volume upon initial installation.

3. All wires and cables, including spares, shall be identified at each end and at any connection. Use durable non-fading sleeve type wire markers to identify all network cables as follows:
  - a. Labels for cabling shall be laser printed, self-laminating, adhesive, polyester (indoor/outdoor).
  - b. Hand-written labels will not be accepted.
  - c. Lettering shall be black on a white background. Characters shall be a minimum of four millimetre high.
  - d. Wire markers are required on each conductor in panel board gutters, and at load connections. The identification shall include branch circuit or feeder number for power and lighting circuits, and control wire numbers for control wiring.
  - e. All field wires and cables terminated within enclosures shall be identified at each termination with a marking that corresponds with the drawings and supporting documentation.
  - f. Power wiring insulation shall be rated at 600 volts at 90 C and be type RW 90 THHN. Conductors shall be stranded copper. No wire smaller than 12 AWG shall be used for power wiring, unless noted otherwise on the drawings.

## **Rack & Cabinet Installation**

1. All cable is to enter through the bottom or top of the cabinets. If coring of the floor is required for the passage of cable the Contractor is to X-Ray the floor in accordance with Division 1.
2. Provide a 12" wide minimum cable tray segregated for power, fibre and horizontal UTP cables for overhead cabling as shown on the Contract drawings. Cable management is to be provided from the cable tray to the enclosure to ensure that the minimum bend radius for each cable is maintained and the cable is rigidly supported.
3. Electrical
  - a. Provide the electrical distribution for each core and server closet as per the related Electrical Distribution drawings and relevant standards.
  - b. Provide each core and server closet with required number of duplex 15A, 120 VAC.
  - c. The project manager will provide UPS Receptacle specification to the contractor, typically one of the following which will be dependent on Load/Runtime requirement or if building generator/UPS is in scope.

UPS Receptacle Option	UPS Series	Input Power
Option 1	APC UPS 1500	NEMA 5-15R
Option 2	APC UPS 2200	NEMA 5-20R
Option 3	APC UPS 3000	NEMA L5-30R
Option 4	APC UPS 5000	NEMA L6-30R

- d. Secure each rack and cabinet to ground.
- e. The duplex receptacles shall be mounted in such a manner as not to interfere with access to or removal of other equipment within the enclosures.
- f. Power distribution within the enclosure shall be via vertically mounted power bars.
- g. Redundant power supplies, within the same device, shall not be connected to the same UPS circuit.

## Network Access Room

1. Network Access Rooms (NAR) shall be large enough to accommodate all of the equipment and wiring that will be placed in it and include extra space to accommodate any future growth.
2. NAR shall meet the requirement of ANSI/TIA-569

## Environmental Specifications

1. Shall satisfy environmental requirements that include, but not be limited to power supply, heating, ventilation, and air conditioning.
2. NAR should maintain a room temperature between 19 to 23 degrees Celsius for the cold zone with the assumption that air flow is from front to back (cold to hot) when all LAN equipment is in full operation and a relative humidity of between 30 to 50 percent.
3. Open water sources are prohibited. Sources include but are not limited to hose bibs, slop sinks, plumbing fixtures and maintenance drains in hydronic heating and cooling.
4. The wiring closet shall not double as a storage area for cleaning products, chemicals, equipment, cardboard, or furniture. The wiring closet shall be kept clean and free of any debris.
5. There should be at least one duplex power outlet positioned every 1.8 meters along each wall of the room and should be positioned 15 cm above the floor. A wall switch that controls the room's main lighting should be placed immediately inside the door.
6. Floor finish to be general service, low volatile organic compound (VOC) solid colored (grey) epoxy coating.
7. UPS plug type and BTU for equipment shall be provided by York Region ITS.

## Cable Access & Support

1. If data closet serves as a Main Distribution Facility/Facilities (MDF), all cables running from it to Intermediate Distribution Facility/Facilities (IDF), computers and communications rooms on other floors of the same building should be protected by a four inch conduit or sleeved core.
2. The exact amount of conduit that is required is determined by the amount of fibre optic, UTP, and STP cable that shall be supported in each NAR.
3. Cabling should be run through four-inch sleeves that are placed above the door level. To ensure proper support, the cable should be run from the sleeve directly onto a 12-inch ladder racked in the room.

4. Supply and install all horizontal wiring, jack boxes, raceway, wall plates, telephone punch-down blocks and identification labels.
5. Identify all wiring at both ends, at the jack end and in wiring closet.
6. Terminate, test and certify all installed wiring in accordance with industry standards.
7. Include additional lengths of conduit to provide for future growth.

## **Property Services — Security Panel**

1. Lenel solutions is used for access control, Bosch for Intrusion and Milestone for CCTV for all new sites. CCTV system is a requirement for facilities accessed by the public unless otherwise specified (examples. Court Services, YRT, ENV and Corporate Sites). This will include an onsite video server, UPS back-up and the XProtect application connected to the database servers at 17250 Yonge Street, Newmarket.
2. Security cabinets shall be placed in the NAR or Electrical room and will require a standard wall space of four feet high by eight feet wide. This may increase depending on the size of the facility and requirements for card access and panic alarms.
3. The following requirements shall be adhered to:
  - a. There shall be 32 square feet of wall space.
  - b. Be eight-inch in depth, and require an additional 28 inches of clearance for a total of three feet.
  - c. Panel area should be situated three feet vertically from the floor and the panel should be installed on fire retardant backboard.
  - d. Security panels should not be placed in mechanical rooms, or general areas opened to staff or other personal.
  - e. Security panels are to be supplied with dedicated emergency power.
4. Category 6A cable, Purple in color should be used for end-to-end horizontal cabling, patch cable and keystone.
5. Facilities with on-site security guards will require a XProtect Smart Client workstation with monitors. The quantity referenced in site specific design and are to be in the security office.

## **Building Automation System (BAS)**

1. Building automation equipment may be in various locations including, but not limited to the NAR, ceiling, mechanical room and the electrical Room.
2. Typical cabinet size that would be expected to be in the NAR.

- a. Two feet wide by three feet high and six inches in depth with a door swing of two feet, seven inches
  - b. Eighteen inches wide by eighteen inches high and six inches in depth with a door swing of nineteen inches
  - c. Quantity maybe one to three depending on number of points Panels should be situated six feet vertically from the panel top to floor and should be installed on fire retardant backboard.
3. Conduits should be used to join the larger cabinets.
4. Power Supply to BAS panel should be separate and has its own junction box or panel.
5. Category 6A cable, Orange in color should be used for end-to-end horizontal cabling, patch cable and keystone.
6. All BAS Category 6A drops shall be terminated to a patch panel in the network rack.
7. Requirement of one data jack per IP device located beside the cabinets in which the devices are located.
8. If placed in the vicinity of a network racks, there should be an additional two feet of clearance.
9. All enclosure wiring shall run through cable management. All cabling is managed, protected, and enclosed.
10. Cable managers shall not be filled to more than 50 percent of their volume upon initial installation.

## Labeling Guidelines

1. All wires and cables shall be identified at each end, and at any connection. Use durable non-fading sleeve type wire markers to identify all network cables as follows:
  - a. Labels for cabling shall be laser printed, self-laminating, adhesive, polyester suitable for indoor and outdoor use.
  - b. Hand-written labels will not be accepted.
  - c. Lettering shall be black on a white background. Characters shall be a minimum of four millimeters high.
  - d. Wire markers are required on each conductor in panel board gutters, and at load connections. The identification shall include branch circuit or feeder number for power and lighting circuits, and control wire numbers for control wiring.

- e. All field wires and cables terminated within enclosures shall be identified at each termination with a marking that corresponds with the drawings and supporting documentation.

## **Category & Fibre Patch Panel Identification**

1. York Region Category and fibre patch panels identification shall follow the standards outlined below. Any exceptions to the following requirements shall be approved by the Region's project manager.
  - a. Labels for patch panels shall be laser printed, self-laminating, adhesive, and polyester or polyolefin.
  - b. Hand-written labels will not be accepted.
  - c. Lettering shall be black on a white background and shall be a minimum of six millimetres high.
  - d. Labels shall be applied to be readily visible, and not obscured by structured cabling or patch cords.
  - e. The tagging convention for network closet patch panels will employ a six-character alphanumeric tag. The first three characters will indicate location consisting of floor and access closet identifier. The last three characters shall use a unique number incrementing with each drop within each closet.

## **Face Plate**

1. York Region UTP patch panel termination point identification shall follow the standards outlined below. Any exceptions to the following requirements shall be approved by the Region's project manager.
  - a. Labels for faceplate shall be laser printed, self-laminating, adhesive, and polyester or polyolefin.
  - b. Hand-written labels will not be accepted.
  - c. Lettering shall be black on a white background and shall be a minimum of four millimetres high.
  - d. A label shall be applied to the top of each faceplate indicating the destination of the faceplate.

## Fibre Optic Patch Panel

1. York Region fibre optic patch panel termination point identification shall follow the standards outlined below. Any exceptions to the following requirements shall be approved by the Region's project manager.
  - a. Terminate all fibres of each fibre optic cable in either 36/72 Fibre Enclosures for access closets, or 36/72/144 Fibre Enclosures for core closets.
  - b. The ordering and colour of individual fibres will be the same for each fibre cable and compliant with ANSI/EIATIA-568.3.
  - c. Labels shall be laser printed, self-laminating, adhesive, and polyester or polyolefin.
  - d. Hand-written labels will not be accepted.
  - e. Lettering shall be black on a white background and shall be a minimum of four millimetres high.
  - f. A label shall be applied to the top of the fibre duplex adapter modules associated with a single fibre cable indicating the destination of the cable.

## Backbone & Horizontal

1. York Region network cable identification shall follow the standards outlined below. Any exceptions to the following requirements shall be approved by the Region's project manager.
  - a. Use durable non-fading sleeve type wire markers to identify all network cables.
  - b. Labels for cabling shall be laser printed, self-laminating, adhesive, and polyester for indoor and outdoor use.
  - c. Hand-written labels will not be accepted.
  - d. Lettering shall be black on a white background and shall be a minimum of four millimetres in height.
  - e. Fibre Optic Backbone Cables
    - i All fibre optic backbone cables are to be labelled at both ends of the cable.
    - ii The fibre backbone cables are to be labelled at each transition. A transition is defined as: a change in ducting (e.g. cable tray to conduit), a change in direction of more than 45 degrees, or an entrance and exit of ducting through a wall or floor.
    - iii If the fibre cable is run in conduit, then the transition labels shall be applied to the conduit.

- iv The tagging convention for identification of fibre optic backbone cables shall indicate the source and destination of the cable.

- b. Horizontal Cables

- i As a minimum, all horizontal Category 6A UTP cable is to be labelled at both ends of the cable.
- ii The tagging convention for identification of horizontal cables shall indicate the drop sequence and Telecommunications Room (TR) of the cable.

## Execution

1. Provide all components and appurtenances necessary to ensure that the network closets are functional and meet the intent of this specification.
2. Locate work area outlets where the length of the horizontal cable runs from the access closet interconnect to the work area outlet shall be less than 90 meters. For work area outlets where this proves impossible the Contract Administrator will authorize in writing an exception if the link still meets the performance requirements of this specification.
3. The Contract Administrator reserves the right to relocate access closets and work area outlets within three metres of the locations identified in the contract drawings at no additional cost to the Region.
4. The contractor is responsible to size all power supply cables to meet the requirements of the Ontario Hydro Safety Code based on field verified length of cable run and power supply load.
5. Cable & Conduit
  - a. Provide one Category 6A UTP, horizontal cables to each work area outlet from an access closet in a Electric Magnetic Tube (EMT) conduit, sized to accommodate quantity of cabling and a minimum trade size of 35 1-1/4.
  - b. Conduit carrying horizontal cables shall enter the work area outlet through the top or bottom.
  - c. Conduit shall be Electric Magnetic Tube conduit (EMT). Corrosive environments will be noted on the access closet Installation drawings. Conduit running through corrosive environments shall be Rigid PVC.

## Work Area Outlets

1. Work Area Outlets
  - a. Horizontal cabling installed using wall outlets and floor boxes are to use single gang, or double gang if required, and they are to match the decora straps. Each

decora style strap is to have a minimum of two positions for communications modules. Each outlet is to be equipped with the appropriate modules. Any unused communication positions in wall outlets shall be filled with a blank. The colours of the UTP modules and furniture adapter plates may be changed at the discretion of the project manager.

- b. Provide one one-port, single-gang, metal work-area outlets, connectors and appurtenances for termination of the horizontal Category 6A UTP cables. If four Category 6A UTP cables are consolidated at the Work Area Outlet, then one four-port work-area outlet is required. If eight Category 6A UTP cables are consolidated at the Work Area Outlet, then one eight-port work-area outlets is required.
- c. Each work-area outlet will be associated with a one-port, snap-in faceplate installed in the access closet or Core Closet patch panel.
- d. All Category 6A UTP connectors shall be modular jacks and wired for a T568A wire-map.
- e. All Category 6A UTP shielded connectors shall be bonded to ground.

## Horizontal Cable Installation

1. All horizontal cabling from the access closet to the work area shall comply with the manufacturer's certification requirements and recommendations; as well as meet the performance parameters of ANSI/TIA-568.2 and the design requirements of ANSI/TIA-568.1.
2. Pathways shall be in EMT conduit minimum trades size 1-1/4 or as specified by the AHJ. Pathways shall be sized according to the requirements of the AHJ in addition to the recommendations of ANSI/TIA-569 with a planned capacity threshold of initial installation requirements +20%.
3. All labeling to confirm to ANSI/TIA-606 and a sample of the proposed labeling scheme to be submitted to the client for approval.

## Fibre Optic Cable Installation

1. All fiber optic cabling from the access closet to the work area shall comply with the manufacturer's certification requirements and recommendations. They shall meet the performance parameters of ANSI/TIA-568.3 and the design requirements of ANSI/TIA-568.1. For outside plant installations, the requirements of ANSI/TIA-758 shall be followed. No cable splices are allowed for inbuilding fiber optic cabling.
2. Indoor pathways shall be in EMT conduit minimum trades size 1-1/4 or as specified by the AHJ. Pathways shall be sized according to the requirements of the AHJ in addition to

the recommendations of ANSI/TIA-569 with a planned capacity threshold of initial installation requirements +20%.

3. All labeling to confirm to ANSI/TIA-606 and a sample of the proposed labeling scheme to be submitted to the client for approval.

## **Appendix A — Horizontal Cable Labelling Format**

First Floor with one data closet

D1-0001 to D1-nnnn

First Floor with multiple data closets

D1A-0001 to D1A-nnnn                      D1B-0001 to D1B-nnnn

Second Floor with one data closet

D2-0001 to D2-nnnn

Second Floor with multiple data closets

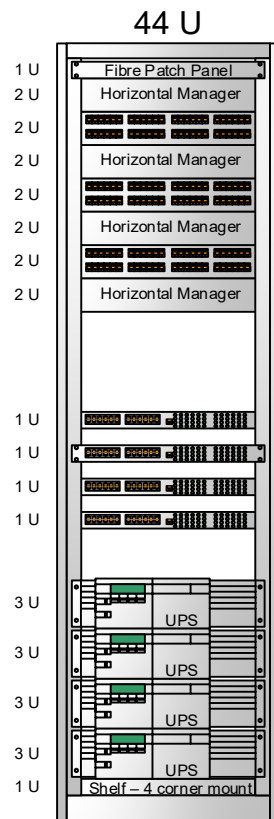
D2A-0001 to D2A-nnnn                      D2B-0001 to D2B-nnnn

Multiple Floors with multiple data closets

Increment the 2<sup>nd</sup> position of the format above for each floor.

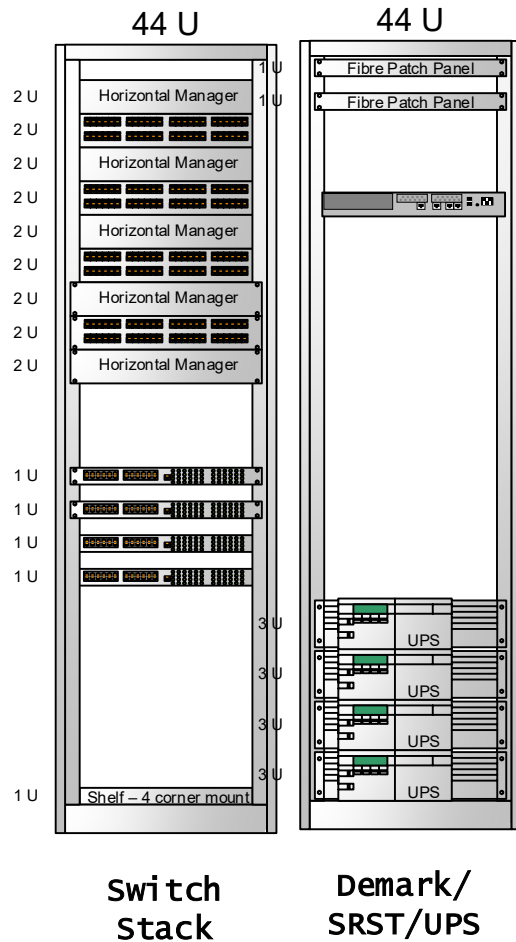
## Appendix B — Network Rack/Cabinet Layout (Single)

Typical Single Network rack/cabinet layout.



## Appendix C — Network Rack and Cabinet Layout (Dual Rack)

Typical Dual Network rack/cabinet layout.



## Appendix D – Network CableTalk Cabinets

<https://www.cabletalk.com/cabinet-solutions>

30"x 42"x 83" - 44U

<b>CTC3-3042K-03PF-B</b>		
CTC3-3042K-B	Cabinet Frame 30"x 42"x 83" - 44U	1
CTC3-30-05-PF-B	Perf Lockable Front Door	1
CTC3-30-03-PF-B	Perf Lockable Split Door	1
CTC3-42-11-B	Solid Side Panels	2
CTC3-MA-16L-B	19" EIA Mounting Angles - Tapped 10/32	2
CTC3-CMS-11-B	Vertical Cable Management	1
CTPBV-1277-B	12 Outlet 15A PowerBar	2

30"x 36"x 83" - 44U

<b>CTC3-3036K-03PF-B</b>		
CTC3-3036K-B	Cabinet Frame 30"x 36"x 83" - 44U	1
CTC3-30-05-PF-B	Perf Lockable Front Door	1
CTC3-30-03-PF-B	Perf Lockable Split Door	1
CTC3-36-11-B	Solid Side Panels	2
CTC3-MA-16L-B	19" EIA Mounting Angles - Tapped 10/32	2
CTC3-CMS-11-B	Vertical Cable Management	1
CTPBV-1277-B	12 Outlet 15A PowerBar	2

## Network Wall Mount Cabinet

<https://www.cabletalk.com/wall-mount-solutions>

<b>CTCWH-2524-DSO-B</b>		
CTCWH-2524-DSO-B	Commercial Wall Mount Cabinet 11U	1
CTPBH-069-B	6 Outlet 15A Powerbar	1
CTC-FS-2	2 Fan Assembly	1

<b>CTCWH-3428-DSO-DR</b>		
CTCWH-3428-DSO-DR	3428 WINDOW FROND DOOR	1
CTCWH-3428-DS0-MB	MID-BODY, 3428-DSO	1
CTCWH-3428-DS0-004	REAR BODY	1
CTCWH-3428-CMS	3428 WALL MOUNT CMS	2

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eDOCS: 5708119

**First published:** July 9, 2012  
**Scheduled review:** Annual  
**Last updated:** March 21, 2025  
**Last Reviewed:** March 21, 2025  
**Approved by:** TSB

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MTG ANGLE		2
CTCWD-D-HINGE-BKT	HINGE BKT MALE	2
CTCWH-2524-DSO-B-014	MID HOUSING, BOLT-ON-HINGE, FEMALE	2
CTC-44-B	COVER PLATE	4

## Appendix E — Network CableTalk 4-Post Open Frame Racks

<https://www.cabletalk.com/4-post-racks>

30"x 36"x 83

<b>CTC3-3036-03-B</b>		
CTC3-3036K-B	Cabinet Frame <b>30"x 36"x 83" - 44U</b>	1
CTC3-MA-16L-B	19" EIA Mounting Angles - Tapped 10/32	2
CTC3-CMS-11-B	Vertical Cable Management	1
CTPBV-1277-B	12 Outlet 15A PowerBar	2

30"x 42"x 83"

<b>CTC3-3042-03-B</b>		
CTC3-3042K-B	Cabinet Frame <b>30"x 42"x 83" - 44U</b>	1
CTC3-MA-16L-B	19" EIA Mounting Angles - Tapped 10/32	2
CTC3-CMS-11-B	Vertical Cable Management	1
CTPBV-1277-B	12 Outlet 15A PowerBar	2

## Appendix F – Network Small Site Deployment Cabinets

Where wall space is limited utilize Hammond HLP Series Low-Profile Wall Mount Rack Cabinet of application-appropriate size and configuration **complete with HWCF Cabinet Sealing and Filter Kit and padlock/lock hasp or equivalent to be approved by York Region.**

<https://www.hamdfg.com/dci/products/wall-mount/hlp#similar-products>



## Appendix G — Network Environmental Services Facilities NEMA4

For Environmental Services' facilities, utilize Nema4 Hoffman ProTek Double-Hinge Solid Door PTHW242424G4 ( or other application appropriate size). Complete with rack-mount, steel shelf vented, back plate, cable management and padlock handle.

<https://hoffman.nvent.com/products/protek-single-door-ul-and-nema-type-4-12-0>

[https://hoffman.nvent.com/sites/g/files/hdkjer316/files/acquiadam\\_assets/2021-09/Spec-00713.pdf?asset\\_type=Data%20Sheet](https://hoffman.nvent.com/sites/g/files/hdkjer316/files/acquiadam_assets/2021-09/Spec-00713.pdf?asset_type=Data%20Sheet)

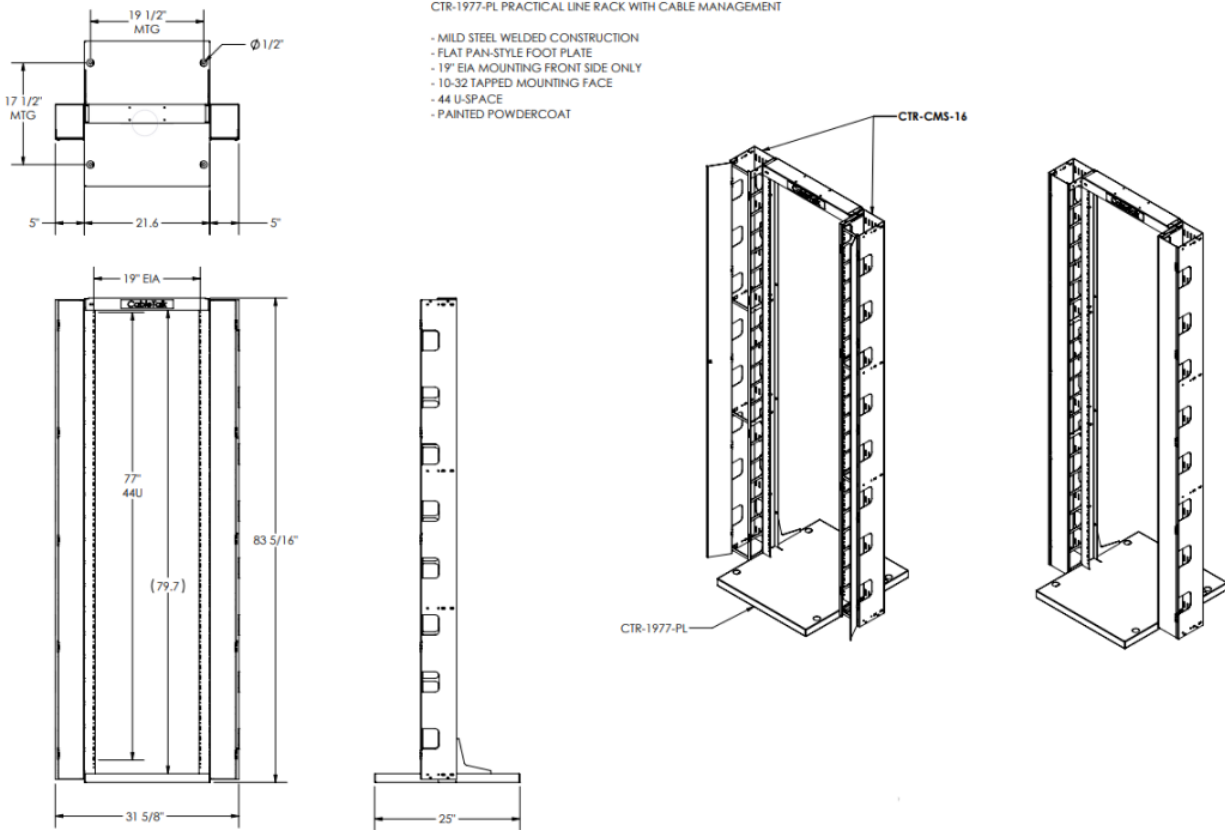


## Appendix H – HP Server Rack

HP 42U 600mm x 1075mm Enterprise Pallet Rack		
HPE-P9K37A	HPE 42U 600x1075 Ent G2 Pallet Rack	1
HPE-P9L15A	HPE G2 Rack 42U 1075mm Side Panel Kit	1
Option - Shelves for HP		
234672-B21	HP 100Kg Sliding Shelf (Sliding)	1
253449-B21	HP Mon/Utl Shelf (Fixed)	1

## Appendix I – Network CableTalk 2-Post Rack

Part Number and Description: CTR-1977-PL Practical Line Rack with Cable Management



## Appendix J – Naming Convention for Wi-Fi Access Point (AP)

### Staff Wi-Fi

1. AP should be labelled: **Site-FL-RM-AP#**. Where Site is Site Name, FL is the floor, RM is the Network Closet Room Number, AP# is the number of AP on that floor and numbering should restart on each floor.
  - a. Ie: AP number 16 on the first floor in the Annex that is cabled back to room 1-006 would be labelled as follows: ANNEX-1-1-006-AP16
2. Data Jack labelling: **RM-AP#**
  - a. Ie: data jack that is used for AP number 16 on the first floor of the Annex that is cabled back to room 1-006 would be labelled as follows: 1-006-AP16
3. Patch Panel should be labelled: **AP#**
  - a. Ie: patch panel that is used for AP number 16 on the first floor of the Annex that is patched back to room 1-006 would be labelled as follows: AP16

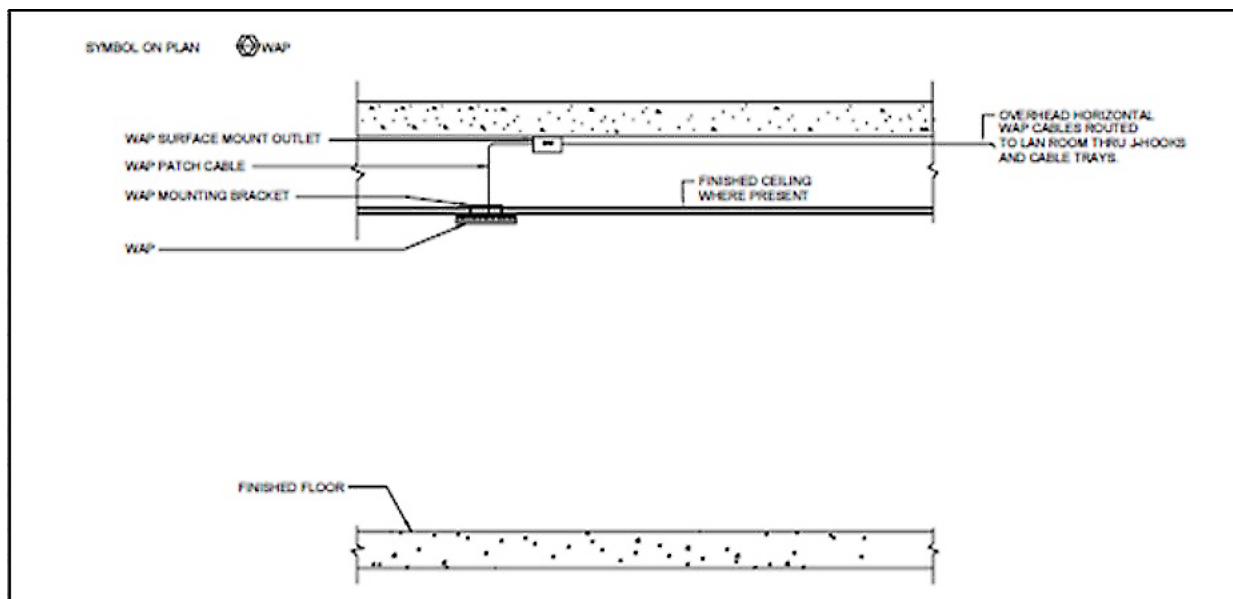
### Public Wi-Fi

4. Public AP should be labelled: **PUB-FL-RM-AP#**. Where PUB represents Public Wi-Fi, FL is the floor, RM is the Network Closet Room Number, AP# is the number of AP on that floor and numbering should restart on each floor.
  - a. Ie: Public Wi-Fi AP number 16 on the first floor in the Annex that is cabled back to room 1-006 would be labelled as follows: PUB-1-1-006-AP16
5. Data Jack labelling: **PUB-RM-AP#**
  - a. Ie: data jack that is used for Public Wi-Fi AP number 16 on the first floor of the Annex that is cabled back to room 1-006 would be labelled as follows:  
PUB-1-006-AP16
6. Patch Panel should be labelled: **PUB-AP#**
  - a. Ie: patch panel that is used for Public AP number 16 on the first floor of the Annex that is patched back to room 1-006 would be labelled as follows:  
PUB-AP16
7. Cabling for Public Wi-Fi shall on a separate patch panel from the York Region internal network.

## Appendix K – Wireless Access Point (WAP) Installation & Mounting

Installation of WAP shall meet the requirements of manufacturer and follow recommendations of TIA-TSB-162.

1. The communication contractor shall install all wireless access points (WAP) which shall be supplied by York Region.
2. Provide patch cable and all necessary hardware to mount WAP's as shown.
3. Communication contractor shall
  - a. Receive WAP's
  - b. Unpack the WAP's
  - c. Attach the WAP's mounting bracket
  - d. Mount the WAP's
  - e. Patch the WAP's at both ends
  - f. Record AP MAC address and WAP Cable ID that AP was patched into. Record this into the AP Connectivity Table that shall be submitted upon AP installation completion of each floor.



## **Appendix L – Category Cabling Color Scheme for Services**

Blue	Data/WiFi/Clock/IoT Category Cable and anything that is not specified.
Purple	Security Category Cable
Orange	BAS Category Cable
Green	Energy Category Cable

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First published: July 9, 2012  
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## Appendix M – Sample Matrix of Port Count Report

For ITS and Cabling Contractor Use

NAC	Data					WAP	IoT	Security Camera		BAS			Energy			TOTAL DATA
Network Access Closets	1-DATA OUTLETS	2-DATA OUTLETS	3-DATA OUTLETS	4-DATA OUTLETS	DATA DROPS	WAP	CLOCK/IOT	SECURITY DEVICE	INTERCOM	BAS	ELEVATOR CONTROL RM	ELECT HOT WATER HEATER	WATER METER	GAS METER	METERS FOR ELECT PANELS	
- N.A. -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEL P1-006																0
TEL G-006																0
TEL 1-108																0
TEL 2-108																0
TEL 2-109																0
TEL 2-006																0
TEL 3-021																0
TEL 3-022																0
TEL 3-006																0
TR located on 4th floor																0
TR located on 5th floor																0
TR located on 6th floor																0
TR located on 7th floor																0
TR located on 8th floor																0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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**First published:** July 9, 2012  
**Scheduled review:** Annual  
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## Appendix N – Network Closet Checklist for Standard Sites

For ITS and Cabling Contractor Use

Walkthrough: 100% ☐ Final ☐

Network Closet : New/Renovated Closet *			
Details (Y/N)	T1	T2	Comment
Cabling Trays or J hooks			
Fire Rated Plywood Wallboard			
Power Receptacles NEMA L5-20R			
HVAC (with central monitoring)			
Rack Installation (clearance for vertical and horizontal cable management)			
Patch Panels			
Fibre Backbone (York Net Sites Only) (shielded/protected/labeled)			
Copper/analog line installed			
Verify that network closets are secure by lock or proximity scanners			
Electrical Grounding			
Room sweep/clean and all refuse/garbage is removed			
Network Closet ready for setup			
Network Closet setup complete			
Cabling Test Submitted and Accepted			
As-Built Diagram Submitted & Accepted			

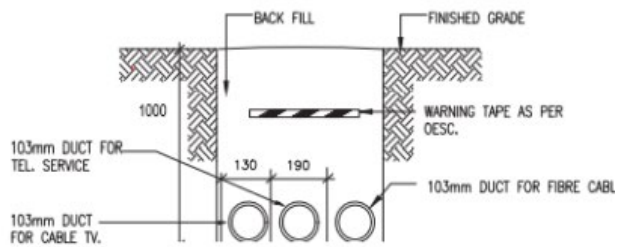
\* Each network closet must have a completed checklist

## Appendix O - WAN/ISP Duct Bank

Communication conduits can be placed on top of electrical conduits

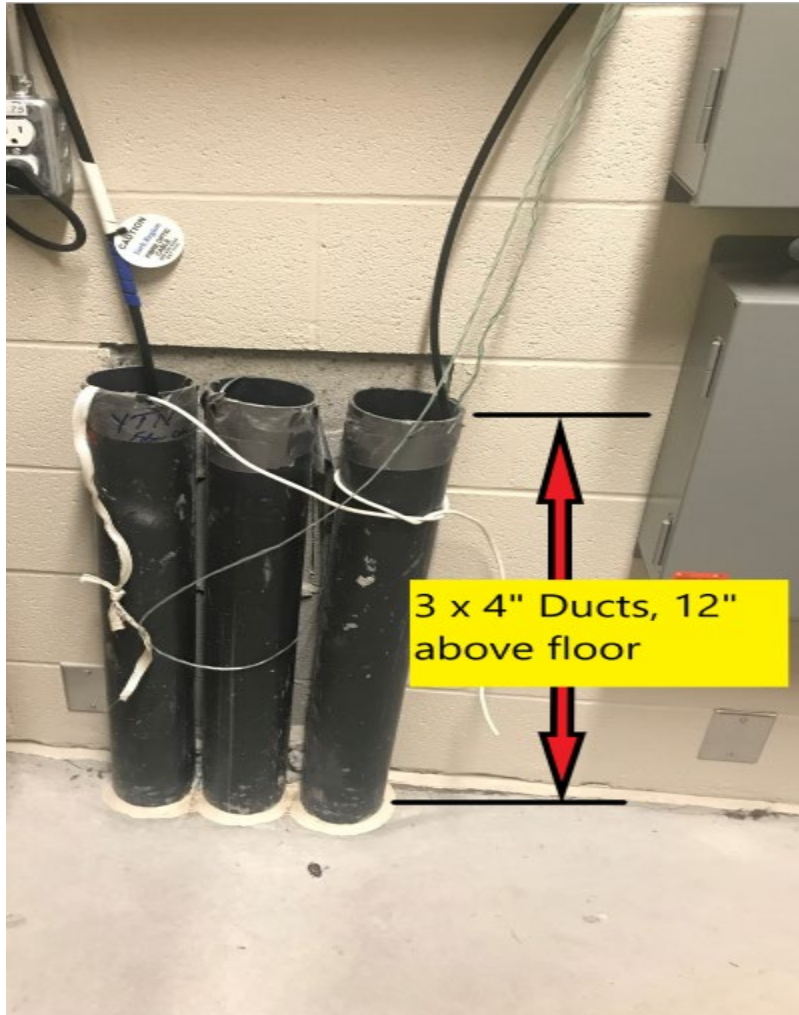
### NOTES:

- .1 PROVIDE DUCTBANK TO OESC STANDARDS AND APPROVAL.
- .2 PROVIDE BELL FITTINGS AT EACH END. PROVIDE DUCT SPACERS AT 1.0M INTERVALS.
- .3 REFER TO SPECIFICATIONS FOR DETAILED DESCRIPTION.
- .4 ALL DIMENSIONS ARE TYPICAL IN MM.



## Appendix P - WAN/ISP Ducts Inside Communication Room

Three 4" ducts stubbed inside communication room, preferred height minimum 12" above the floor.



## References

York Region Transit local area network	eDocs: 1027531
American National Standards Institute	<a href="http://www.ansi.org">http://www.ansi.org</a>
Canadian Standards Association	<a href="http://www.csa.ca">http://www.csa.ca</a>
Construction Specifications Institute/Construction Specifications Canada	<a href="http://www.masterformat.com">http://www.masterformat.com</a>
European Committee for Electrotechnical Standardization (ECES)	<a href="http://www.cenelec.eu/Cenelec/Homepage.htm">http://www.cenelec.eu/Cenelec/Homepage.htm</a>
International Electrotechnical Commission (IEC)	<a href="http://www.iec.ch">http://www.iec.ch</a>
International Organization for Standardization	<a href="http://www.iso.ch/iso/en/ISOOnline.frontpage">http://www.iso.ch/iso/en/ISOOnline.frontpage</a>
Internet Engineering Task Force	<a href="http://www.ietf.org">http://www.ietf.org</a>
IEEE	<a href="http://www.ieee.org">http://www.ieee.org</a>
Ontario Realty Corporation	<a href="http://www.orc.on.ca/site3.aspx">http://www.orc.on.ca/site3.aspx</a>
Telecordia Technologies Inc.	<a href="http://telecom-info.telecordia.com">http://telecom-info.telecordia.com</a>
Telecommunications Industry Association	<a href="http://www.tiaonline.org">http://www.tiaonline.org</a>
Underwriters Laboratories Inc.	<a href="http://www.ul.com">http://www.ul.com</a>