

Wiring Topology for Government Buildings-Voice and Data Telecommunications

Government of Ontario



Management Board Secretariat

Foreword

Government of Ontario Information & Technology Standards are the official publications on the standards, guidelines, technical reports and preferred practices adopted by the Information & Technology Standards Council under delegated authority of the Management Board of Cabinet. These publications support the Management Board Secretariat's responsibilities for coordinating standardization of Information and Technology in the Government of Ontario. Publications that set new or revised standards provide policy guidance and administrative information for their implementation. In particular, they describe where the application of a standard is mandatory and specify any qualifications governing its implementation.

Amendment Notice (July 1996)

The reader should note that this version of the Standard has been improved over the previous release by the insertion of changes, in the same manner as indicated by this paragraph.

Abstract

This standard defines the requirements for the wiring of data and voice communications in Government of Ontario buildings.

Implementation Criteria

1.1 Category

Mandatory Standard

1.2 Related Documents

Ontario Realty Corporation, Property Development Division

Architectural and Electrical Master Specifications

Division 1 General Requirements

Section 07270 - Penetration Fire Stopping

Section 10270 - Access Floor

Section 16010 - General Electrical Requirements

Section 16115 - Signal and Communications, Raceways and Fittings

Canadian Standards Association

CSA:CSA 22.1-94 1994 Canadian Electrical Code Part 1(17th edition), Safety Standards for Electrical Installations

CSA C22.2 No 214M-94 Communications Cables (Binational Standard with UL444)

CSA C22.2 No 232-M1988(R1994) Optical Fibre Cables

CAN/CSA T527-94 Grounding and Bonding for Telecommunications in Commercial Buildings

CAN/CSA T528-93 Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings, Adopted ANSI/EIA/TIA 606 with Modifications
CAN/CSA T529-95 Telecommunications Cabling Systems in Commercial Buildings
CSA Standard C22.2 No 232-M1988(R1994) Optical Fibre Cables
CAN/CSA T530-M90 Building Facilities Design Guidelines for Telecommunications

American National Standards Institute(ANSI)/Electronic Industries Association (EIA) Telecommunications Industries Association(TIA) Insulated Cable Engineers Association Incorporated(ICEA)

ANSI/ICEA S-80-576-1990 Telecommunications Wire and Cable for Wiring of Premises
ANSI/ICEA S-83-596-1988 Fibre Optic Premises Distribution Cable
UL LR 67725 Modular Jack
ANSI/EIA/TIA 455-34-1985 Fibre Optics-Interconnection Device Insertion Loss Test
ANSI/EIA/TIA 455-51A-1991 Pulse Distortion Measurement of Multimode Glass Optical Fibre Information Transmission Capacity
ANSI/EIA/TIA 455-30B-1991 Frequency Domain Measurement of Multimode Optical Fibre Information Transmission Capacity
ANSI/EIA/TIA 568-1991 Commercial Building Telecommunications Wiring Standard

Bellcore Customer Service

Bellcore TR-TSY-000020 Mechanical and Environmental Specifications for Outdoor Fibre Optic Cable

Federal Communications Commission Authorities

Canadian Radio - Television & Telecommunications Commission of Industry Canada (CRTC)
FCC Part 68 Requirements - Rational and Measurement Guidelines

Underwriters Laboratories Incorporated

(UL) 94-V2 - Flame Rating Underwriters Laboratories of Canada (ULC)

2 Purpose

This GOITS defines the design, and the minimum technical and quality requirements, for

the wiring of voice and data communications in all buildings that are managed by, or on behalf of, the Government of Ontario for the provision of government services by its clusters/ministries and all former Schedule I and IV provincial government agencies.

The objectives of the standard are to:

- 1) To provide safe, reliable, uniform, and up-to-date facilities for the convenient connection of telephones, computers, computer terminals, FAX machines and video communications equipment in government offices;
- 2) By uniform and flexibly-arranged communications connections, to achieve significant cost-savings in the rearrangement of government offices and the relocation of government services and personnel.

3 Application

This standard applies to all new buildings, and major refits to existing buildings.

4 Specifications

See Technical Specifications.

5 Qualifications

Government of Ontario IT Standards and Enterprise Products apply (are mandatory) for use by all clusters/ministries and to all former Schedule I and IV provincial government agencies under their present classification (Advisory, Regulatory, Adjudicative, Operational Service, Operational Enterprise, Trust or Crown Foundation) according to the current agency classification system. Additionally, this applies to any other new or existing agencies designated by Management Board of Cabinet as being subject to such publications.

Kindly refer to

http://intra.pmed.mbs.gov.on.ca/mbc/pdf/Agency_Establishment&Accountability-Dir.pdf for a list of provincial government agencies with their classification under the

current classification system, as well as their previous Schedule under the former Schedule system.

6 Implementation

The effective date of this standard is June 1995.

7 Where to obtain copies

Copies of related documents may be obtained as follows:

ANSI Standards

American National Standards Institute (ANSI) 430 Broadway New York, NY 10018 USA
(212)642-4900

ASTM

American Society for Testing and Materials (ASTM) 1916 Race Street Philadelphia, PA
19103 USA (215)299-5400

Bellcore

Bellcore Customer Service
8 Corporate Place Room 3C-183
Piscataway, NJ 08854-4156
(800)521-2673

CSA Standards

Canadian Standards Association (CSA)
187 Rexdale Blvd.
Rexdale (Toronto), Ontario
Canada M9W 1R3
(416)747-4363

EIA

2500 Wilson Blvd., Suite 400
Arlington, VA22201-3836

USA
(703)907-7500

FCC
Federal Communications Commission (FCC)
Washington, DC 20554
USA
(301)725-1585

Federal and Military Specifications
US Department of Commerce
National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
USA

ICEA
Insulated Cable Engineers Association Inc. (ICEA)
PO Box 440
South Yarmouth, MA 02664
USA
(508)394-4424

IEC
International Electrotechnical Commission (IEC)
Sales Department PO Box 131
3 rue de Varembe
1211 Geneva 20
Switzerland
+41 22 34 01 50

Note: AIs obtainable from ANSI

IEEE

The Institute of Electrical and Electronic Engineers Inc. (IEEE)

IEEE Service Center
445 Hoes Ln. PO Box 1331
Piscataway, NJ 08855-1331
USA
(201)981-0060

IPC

The Institute for Interconnecting and Packaging
Electronic Circuits
3451 Church Street
Evanston, IL 60203
USA

ISO

International Organization for Standardization (ISO)
1, Rue de Varembe
Case Postale 56
CH-1211 Geneva 20
Switzerland
+41 22 34 12 40

NEMA

National Electrical Manufacturers Association (NEMA)
2101 L Street
Washington, D.C. 20037
USA
(202) 457-8400

NIST (source for FIPS PUB)

National Institute for Standards and Technologies
Gaithersburg, MD 20899
USA

(301) 975-2833

NFPA

National Fire Protection Association

Batterymarch Park

Quincy, MA 02269

USA

SCTE

Society of Cable TV Engineers

669 Exton Commons

Exton, PA 19380

USA

TIA

Telecommunications Industry Association (TIA)

2500 Wilson Blvd., Suite 300

Arlington, VA 22201-3836

USA

(703) 907-7700

UL

Underwriters Laboratories Inc. (UL)

333 Pfingsten Road Northbrook, IL 60062

USA

(312) 272-8800

ULC

Underwriters Laboratories of Canada

7 Crouse Road

Scarborough, Ontario

Canada M1R 3A9

(416) 757-3611

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Technical Specifications

Specifications for Communications Cabling for the Government of Ontario

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1.0 Part 1: General

1.1 Summary

- 1.1.1 Provide a complete and operating Structured Cabling Platform to support existing and future Voice/Data network systems in the building. This will include all horizontal cabling for Voice/Data applications as well as Voice and Data backbone (if required). Active equipment and accessories are NOT included in the scope of work.
- 1.1.2 The Horizontal Structured Cabling Platform that is installed must meet or exceed the Channel requirements for Voice/Data transmissions as defined by Addendum No. 5 to ANSI/TIA/EIA-568-A 'Transmission Performance Specifications for 4-pair 100 Ohm Category 5e Cabling'. In addition, the entire Structured Cabling Platform must provide a lifetime system performance guarantee and minimum 20 year product warranty against defect or workmanship.

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 Government of Ontario requirements. The Cabling Contractor

must adhere to all Standards and practices of ANSI/EIA/TIA-568-A-95, its' Addenda and associated documents.

1.1.3 Installation will be to locations identified by the cluster/ministry Customer who authorises the work (hereafter known as "the Customer").

1.1.4 Horizontal Voice cabling must be installed from the workstation location to a Backboard (supplied and installed by the Cabling Contractor).

There are two scenarios for the horizontal Data cabling in the Telecommunications Closet:

In scenario A, the horizontal Data cabling must be installed from the workstation location on to modular patch panels installed in to Communications Racks (supplied and installed by the Cabling Contractor). For small sites, the Customer can specify wall-mounted patch panels in lieu of racks.

In scenario B, the horizontal Data cabling must be installed from the workstation location to IDC (Insulation Displacement Connectors) mounts on the Backboard. For scenario B, the Cabling Contractor will be required to supply open/RJ45 Data 'pigtailed' (described further in the document). The Cabling Contractor must confirm with the Customer, which scenario is to be used prior to installation.

Only one scenario will be used at a site. All new cable installed is to match the scenario that already exists. If it is a new site then scenario A is preferred.

1.1.5 If required, the Cabling Contractor will supply, install and test all Category 3 multi-pair backbone cabling including terminating hardware for a complete functioning Voice backbone. Similarly, the Cabling Contractor will supply, install and test all fiber backbone and UTP copper cabling between Telecommunications closets for a complete functioning Data backbone.

1.2 Related Sections of CSI/CSC Master Format

1.2.1 Conform to Sections of Division 1 as applicable.

1.2.2 Conform to General Electrical Requirements as applicable, reference Section 16010.

1.2.3 Conform to Firestopping and Smoke Seals, as applicable, reference Section 07840 (Penetration Firestopping).

1.2.4 Conform to Access Flooring, as applicable, reference Sections 10270 and 10271 (Access Flooring and Refurbished Access Flooring respectively).

1.2.5 Conform to Acoustic Ceilings, as applicable, reference Sections 09510 and

09511 (Acoustic Ceilings).

1.3 Allowances

- 1.3.1 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 3.05m (10'-0') without adjustment to the Contract price.

1.4 Dimensions and Quantities

- 1.4.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurements.
- 1.4.2 Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.
- 1.4.3 Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, **written permission** must be obtained from the Communications Consultant prior to installation.

1.5 Applicable Codes, Standards and Regulations

- 1.5.1 The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards and regulations of authorities having jurisdiction, listed below. All references to Codes, Standards and regulations should first be made with respect to Canadian documents. In the case of conflict or discrepancy the more stringent code shall apply.

Standard	Title
ANSI/EIA/TIA-455	Fiber Optic Test Procedures
ANSI/ICEA S-80-576	Communication Cables.
ANSI/ICEA S-83-596-1988	Fiber Optic Premises Distribution Cable.
ANSI/ICEA S-83-640-1992	Fiber Optic Outside Plant Communications Cable.
ANSI/ Z136.2	American Standards for the Safe Operation of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources.
ANSI/TIA/EIA-472CAAA-93	Detail Specification for All-Dielectric (Construction 1) Fiber Optic Communications Cable for Indoor Plenum Use, Containing Class Ia, 62.5 mm Core Diameter/125 Cladding Diameter Optical Fiber(s).
ANSI/TIA/EIA-472DAAA-93	Detail Specification for All-Dielectric Fiber Optic Communications Cable for Outside Plant Use, Containing Class Ia, 62.5 mm Core Diameter/125 mm Cladding Diameter/250 mm Coating Diameter Optical Fiber(s).
ANSI/EIA/TIA-492AAAA-98	Detail Specification for 62.5-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibers.
ANSI/EIA/TIA-492AAAB-98	Detail Specification for 50.0-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibers.
ANSI/EIA/TIA-492BAAA-98	Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Waveguide Fibers Used In Communications Systems.
ANSI/TIA/EIA-568-A-95	Commercial Building Telecommunications Cabling Standard.
ANSI/TIA/EIA-568-A-1-97	Propagation Delay and Delay Skew Specifications for 100 Ohm 4-pair Cable.
ANSI/TIA/EIA-568-A-2-98	Corrections and Additions to TIA/EIA-568-A
ANSI/TIA/EIA-568-A-3-98	Addendum No. 3 to TIA/EIA-568-A.
ANSI/TIA/EIA-568-A-4-99	Proposed Addendum No. 4 to TIA/EIA-568-A, ' Production Modular Cord NEXT Test Method and Requirements for Unshielded Twisted-Pair Cabling'.

ANSI/TIA/EIA-568-A-5-99	Addendum No. 5 to TIA/EIA-568-A 'Transmission Performance Specifications for 4-pair 100 Ohm Category 5e Cabling'.
ANSI/TIA/EIA-568-B.1	Proposed Category 6 'Transmission Performance Specifications for 4-pair 100 Ohm Category 6 Cabling', Draft 5 (May 25, 1999).
ANSI/EIA/TIA-569-A-98	Commercial Building Standards for Telecommunications Pathways and Spaces.
ANSI/TIA/EIA-598-A-95	Optical Fiber Cable Color Coding.
ANSI/EIA/TIA-570-91	Residential and Light Commercial Telecommunications Wiring Standard.
ANSI/EIA/TIA-604-3	Plugs, Receptacles, and Connectors for Communication Systems.
ANSI/EIA/TIA-606-93	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
ANSI/EIA/TIA-607-94	Commercial Building Grounding and Bonding Requirements for Telecommunications.
CSA-C21.1-98	Canadian Electric Code Part I: Safety Standards for Electrical Installations.
CSA-C21.2 No. 181.4-M90	Plugs, Receptacles, and Connectors for Communication Systems.
CSA-C21.2 No. 214-94	Communications Cables.
CSA-C21.2 No. 0-M91 (R1997)	Canadian Electric Code Part II: General Requirements (Communications Cables).
CSA-C21.2 232 M1998 (R1994)	Canadian Electric Code Part II: Optical Fiber Cables.
CAN/CSA-T527-94	Grounding and Bonding for Telecommunications in Commercial Buildings.
CAN/CSA-T528-93 (R1997)	Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings.
CAN/CSA-T529-95	Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.
CAN/CSA-T530-M90	Building Facilities, Design Guidelines for Telecommunications.
CEC, Part 1	The Canadian Electrical Code, Part 1.

CENELEC EN 50173	Performance Requirements for Generic Cabling Schemes.
FIPS PUB 174	Commercial Building Telecommunications Wiring Standard. Federal Information Publication Standard.
IEC 603-7, Part 7	Detailed Specifications for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Schemes.
IEC 807-8-7	Rectangular Connectors for Frequencies Below 3MHz, Part 8: Detailed Specification for Connectors, Four Signal Contacts and Earthing Contacts for Cable Screens, First Edition.
ISO/IEC IS 11801A	Generic Cabling for Customer Premises.
NEMA WC 63	Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System.
Ontario Regulation 388/97	Ontario Fire Code.
Ontario Regulation 403/97	Ontario Building Code 1997.
TIA/EIA-604-3	Fiber Optic Connector Intermateability Standard (Focis 3).
TSB67	Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
TSB72	Centralized Fiber Optic Cabling Guidelines.
TSB75	Additional Horizontal Cabling Practices for Open Offices.
UL 444 and 13	Adopted Test and Follow-Up Service Requirements For the Optional Qualification of 100ohm; Twisted-Pair.

1.6 **Definitions**

1.6.1 The following terms are used throughout this document.

Cabling Contractor:	The successful bidder to the Tender Document is responsible for the supply and installation of the Structured Cabling Platform and the Copper and Fiber backbones (if required).
Communications Consultant:	All references to Communication Consultant are to an individual or group who is to oversee the Structured Cabling Platform installation, the Project Manager may assume this role.
Customer:	The Project Managers' Customer (usually cluster/ministry) will hereafter be referred to as the 'Customer, the Customer will own the Structured Cabling Platform at the end of the Project.
Project:	Supply and installation of a complete Horizontal UTP Structured Cabling Platform, and Copper and Fiber backbone (if required) to support Voice and Data applications as described in this document.
Project Manager:	All references to 'Project Manager' shall be assumed to be the Customer's Project Manager, this person will be determined on a project by project basis. An "Integrator" engaged by the Government of Ontario to deliver Network Access Service to the Ontario Public Service may be assigned this role.

1.6.2 The following definitions are to be used throughout this document.

TC	Telecommunications Closet where horizontal voice and data cables are terminated for every floor.
Main Telecommunications Closet	The Main Telecommunications Closet is where the Servers/Phone Switch are housed for the facilities operation. This is also the room where all external connections (circuits and or trunking) are located. Each of the TC's have their backbone cabling fed back to the Main Telecommunications Closet.

1.7 **System Description**

1.7.1 The Cabling Contractor must **supply and install** a complete Structured Cabling Platform based on a physical star wiring topology that is designed in accordance with and supported by a manufacturer backed Certification as specified herein. The Cabling Contractor shall include all communication outlets, terminating hardware and selected connectivity devices as outlined in this Specification.

1.8 Performance Requirements

1.8.1 The following table is for the horizontal Cabling performance requirements. The Cabling Contractors proposed solution offered must meet, as a minimum, all of the performance parameters as defined in the tables in this section. If there are any discrepancies, in the following tables, with respect to EIA/TIA-568-A (Category 5) and Addendum No. 5 to TIA/EIA-568-A 'Transmission Performance Specifications for 4-pair 100 Ohm Category 5e Cabling' the latter shall be considered correct. The following table values are for a worst case 4 connector topology including consolidation point and cross connects using swept frequency measurements.

Frequency	Maximum Channel Attenuation	Minimum Channel PSNEXT	Minimum Channel PSACR	Minimum Channel PSELFEXT
(MHz)	(dB at 100 m)	(dB at 100 m)	(dB at 100 m)	(dB at 100 m)
1	1.2	60.3	58.0	54.4
4	4.5	50.5	46.1	41.4
8	6.3	45.6	39.3	36.3
10	7.1	44.0	36.9	34.4
16	9.1	40.6	31.5	30.3
20	10.2	39.0	28.8	28.4
25	11.4	37.3	25.9	26.4
31.25	11.9	35.7	21.9	24.5
62.5	18.6	30.6	11.0	18.5
100	24.0	27.1	3.1	14.4

Frequency	Minimum Cable Return Loss	Minimum Connector Return Loss	Minimum Channel Return Loss	Maximum Cable Propagation Delay
(MHz)	(dB)	(dB)	(dB)	(ns)
1	20	35	17	570
4	23	35	17	552
8	25	35	17	547
10	25	35	17	545
16	25	35	17	543
20	25	34	17	542
25	24	32	16	541
31.25	24	30	15	540
62.5	22	24	12	539
100	20	20	10	538

Frequency	Maximum Channel Propagation Delay	Maximum Channel Delay Skew
(MHz)	(ns)	(ns)
1	580	50
4	562	50
8	557	50
10	555	50
16	553	50
20	552	50
25	551	50
31.25	550	50
62.5	549	50

100	548	50
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1.9 Connectivity Database

1.9.1 The Cabling Contractor will be required to provide all patching for complete connectivity as indicated below. The Cabling Contractor must provide a complete end to end mapping of all connectivity (including horizontal and vertical) at the end of each phase in both hard and soft copy format. Initial data capture will be using **Microsoft Excel**, enabling subsequent upload of the data to a relational database, such as **MS Access**, for information store and profile generation. For Voice connectivity, this is to include but not be limited to horizontal Voice cable number, backbone pair, service provider demarcation pair(s), DID and LEN. For data connectivity, this is to include but not be limited to horizontal Data cable number, copper backbone cable (if required) and active equipment port. Also included will be fiber backbone connectivity.

1.10 Codes, Permits and Inspections

1.10.1 Comply with the Ontario Hydro Electrical Safety Code, all local, provincial and federal laws, where applicable and with requirements of the Canadian Standards Association (CSA) when mandatory. Make any changes or alterations required by the authorised inspector of the authority having jurisdiction.

1.10.2 Where materials are specified which require special inspection and approval of CSA and/or local authorities, obtain such approval for the particular installation with the co-operation of the material supplier.

1.10.3 Obtain and pay for permits and inspection required for work performed.

1.11 Delivery, Storage and Handling

1.11.1 Arrange for the delivery of materials related to Communications Contract and related items, including unloading of supplier's truck, elevator scheduling and placement on Customer premises as indicated on Contract drawings.

1.12 Packing, Shipping, Handling and Unloading

1.12.1 The Cabling Contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.

1.13 Acceptance on Site

- 1.13.1 It is the responsibility of the Cabling Contractor to co-ordinate the delivery and storage of all materials used for the project with the General Contractor/Site Superintendent.

1.14 Storage and Protection

- 1.14.1 The Cabling Contractor is allowed to store job boxes on the site during construction. The tools and the job box are the responsibility of the Cabling Contractor. The Customer and his representative are in no way responsible or liable for any tools of the Cabling Contractor.
- 1.14.2 Cabling Contractor is responsible for the assembly of equipment/materials and protection of the above equipment and related items until project Cut Over. Any damage to equipment will be the liability of the Cabling Contractor. All damage must be repaired or at the Customer's request, the equipment must be replaced at no extra charge to the Customer.

1.15 Waste Management and Disposal

- 1.15.1 The Cabling Contractor must remove and dispose of all existing inactive horizontal Voice, Data and coaxial cabling. If the Cabling Contractor is unsure of the status of a cable(s), they must confirm the removal with the Customer prior to performing and work.

1.16 Warranty and Certification

- 1.16.1 From the date of issuance of a 'Certificate of Substantial Performance', all equipment, materials and workmanship must be unconditionally Warranted for a period of one (1) year, or such longer periods as may be provided in the Warranty of the manufacturer of individual components, whichever is longer.
- 1.16.2 Provide a manufacturer written certificate and Warranty that the Structured Cabling Platform is installed and fully operating in accordance with this and the manufacturers specifications.
- 1.16.3 The manufacturer is required to provide a minimum 20 year parts and labour Warranty for the entire Structured Network Cabling System, including UTP copper, UTP backbone and fiber. In addition, the manufacturer will be required to provide a lifetime application Warranty that covers any current or future Category 5 and/or Enhanced Category 5 applications recognised by standards bodies and user forums for use over EIA/TIA 568-A component and Channel specifications.

The Warranty must guarantee that the design or installation negligence on the part of the Cabling Contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and

labour are covered in this circumstance for the full certification period. It must also guarantee that in the event a Cabling Contractor is no longer able to service the Warranty, the full certification remains valid and is responsibility of the manufacturer.

- 1.16.4 If a Warranty issue arises for the cabling the Warrantor must make arrangements to undertake the repair or replacement of Warranty issues within 24 hours of notification. This may require the repair/replace of cabling components outside regular working hours at no additional cost.
- 1.16.5 The Warranty for the Cabling must be such that the cable meets or exceeds the requirements of EIA/TIA-568-A and EIA/TIA-568-A-5 'Transmission Performance Specifications for 100 Ohm 4-pair Category 5e Cabling' including all Standards stated in this Contract.
- 1.16.6 The Cabling Contractor shall forward the Structured Cabling Platform certification request form(s) to the proper authority and ensure that a **Plaque and Certificate** is issued to the Customer along with the Structured Cabling Platform user manual. The successful bidder will provide a certification number within two weeks of award of this project. Please note that the Plaque/Certificate must have the Customer name on the Plaque/Certificate.
- 1.16.7 The Cabling Contractor will provide letter(s) of Certification within **two weeks** of substantial completion of the project to the Customer. This document will include the following: verification of the performance of the installed system, identification of the installation by location and project number and a copy of the Warranty.
- 1.16.8 Upon award of contract, the Cabling Contractor shall forward copies of the Structured Cabling Platform Request for Certification form complete with certification number(s) for the project to Customers office **within 7 days** of the award of contract.
- 1.16.9 Upon request and at no additional cost to the Customer the Cabling Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.
- 1.16.10 The Cabling Contractor must supply a copy of an unexecuted Warranty statement (at the time of bidding) including all related terms and conditions. This copy will be the Standard to which the Warranty will be held. No changes will be accepted unless it is deemed to benefit the Customer. Any proposed changes to the Warranty must be submitted in writing to the Customer/their representative for review. The changes will then be accepted or declined by the Customer at their discretion. This is to remain valid for the entire Warranty period.
- 1.16.11 All cable Cabling Contractor technicians on site must be trained by the

manufacturer of the Structured Cabling Platform being installed.

- 1.16.12 Any defective or improperly installed products shall be replaced, or correctly reinstalled at no cost to the Customer.

1.17 Testing and Commissioning

- 1.17.1 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 Managers request. Include maintenance manuals, operating instructions for Customer's staff use.

2.0 Part 2: Products

2.1 General

- 2.1.1 As mentioned in Section 1.1, there are two scenarios for the horizontal Data cabling termination in the Telecommunications Closet. Only one scenario will be used at a site. All new cable installed is to match the scenario that already exists on site. If it is a new site then scenario A is preferred.

Scenario A is the termination of the horizontal Data cable on to modular patch panels into Communications Racks. Scenario B is the termination of horizontal Data cabling on to IDC mounts on the Backboard. For scenario B, the Cabling Contractor will be required to supply open/RJ45 'pigtailed' to patch the data cables from the Backboard to the Customer supplied active equipment. The Project Manager will determine, with the concurrence of the Customer, the Scenario that will be used for the site.

This document specifies the use of an end to end Structured Cabling Platform as manufactured and Warranted by a Single Manufacturer. No alternatives will be accepted except where noted or where supply of the materials would compromise the schedule. If the supply of the materials is such that the schedule will be compromised, written permission of the Communications Consultant must be obtained before alternatives are purchased or installed. Bidders must identify alternative products with their bids including Manufacturer and Part Number.

- 2.1.2 The Cabling Contractor shall terminate a pre-determined number of Category 5e Voice and Data cables to each specified user workstation location, or office as shown on the floor plans provided by the Customer. Every Voice and Data cable that is pulled must be terminated and tested.

2.2 Manufacturers

- 2.2.1 The Structured Cabling Platform in each individual building/site must be manufactured and warranted by a single manufacturer for all components of

the horizontal Channel and Voice/Data backbones.

- 2.2.2 The successful bidder must install a complete Structured Cabling Platform that is **manufactured and warranted by a single vendor**. The successful bidder must be currently authorised to install and Warranty the system. If a sub-Contractor is being used for the installation, it is mandatory that the sub-Contractor be currently authorised to install and Warranty the system.

2.3 **Horizontal Transmission Media**

2.3.1 Horizontal Voice and Data Cable:

Enhanced Category 5, UTP, 4 pair, 24 AWG, CMR/CMP rated (FT6/FT4) Horizontal Cable

All horizontal Voice and Data Cable must support the following requirements:

The full end to end 100 meter channel that includes a worst case of four terminations (including consolidation point and cross connect) must meet all of the criteria (as a minimum) as defined in Section 1.10. The Channel performance specifications for all of the parameters in Section 1.10 must be tested (and published) up to and including 155 MHz and Warrantable up to and including 100 MHz for a minimum period of 20 years.

All future reference to 'Voice Cable' shall refer to the requirements as stated in this section. The cable must meet or exceed the requirements of EIA/TIA-568-A (Category 5) and Addendum No. 5 to TIA/EIA-568-A 'Transmission Performance Specifications for 4-pair 100 Ohm Category 5e Cabling'. The cable must be CSA certified and stamped accordingly. All Enhanced Category 5 UTP Data cable shall have a Blue outer jacket. All Enhanced Category 5 UTP Voice cable shall have a White outer jacket. Other colours may be acceptable if approved in writing by the Project Manager.

All cables pulled and terminated for Servers are to be treated exactly the same as other Horizontal Voice and Data cables.

2.4 **Backbone Transmission Media**

- 2.4.1 The following items are to be installed only if the Customer requires them. In all cases, the Cabling Contractor is to confirm, with the Project Manager, the quantities required (pairs for Category 3, strands for Fiber backbone and number of cables for UTP backbone).

- 2.4.2 The Cabling Contractor is to use the cables listed below for inter-building connectivity, if required. The Cabling Contractor is to ensure that the cables will perform to the Standards and maintain their integrity as the cables are distributed between buildings. This is to include but not be limited to protection from moisture ingress and mechanical protection.

2.4.3 Multi-pair Category 3 Backbone Cable for Voice Applications

The multi-pair Voice backbone cable shall be Category 3, riser grade cable. The cable must have the following attributes:

- 24 AWG solid copper conductors formed into 25-pair bundle groups.
- Sheath must be CMP/CMR riser rated (FT6/FT4) and be made of an ALVYN (ALPAST). It must have a longitudinally applied, transversely corrugated aluminum shield that is bonded to an outer jacket of PVC.
- The cable must meet or exceed requirements of EIA/TIA-568-A for (Category 3). The cable must be CSA certified and stamped accordingly

2.4.4 62.5 um Multimode Fiber Backbone for Data Applications

Each fiber backbone for Data applications shall have a minimum of 12 strands (24 strands preferred) of multimode 62.5/125 um distribution type fiber. The fiber cable must have the following attributes:

- 12/24 individual strands of multimode fiber each must be colour coded for easy identification and all fibers must be packaged within one larger outer jacket. The fibers must be reinforced with an Aramid yarn for strength.
- The fiber cable must be CMP/CMR rated (FT6/FT4).
- The core must be 62.5 um \pm 3 um.
- The cladding must be 125 um \pm 4 um.
- The jacket buffering must be 900 um.
- Numerical Aperture 0.275 \pm 0.015.
- The core cladding offset must be less than 3 um.
- The core non-circularity must less than 6%.
- The cladding non-circularity must less than 2%.

The Cabling Contractor is to verify that the 62.5/125 um distribution type fiber will perform to Standards over the distance required for the site. Alternatively, if distance limitations and/or application necessitate, a 50 micron multimode or a single mode distribution type fiber installation may be required. The Project Manager will determine, with the concurrence of the Customer, the distribution type fiber and number of strands to be installed. For small or old facilities, a 6-strand Backbone may be considered.

2.4.5 50 um Multimode Fiber Backbone for Data Applications

Each fiber backbone for Data applications shall have a minimum of 12 strands (24 strands preferred) of multimode 50/125 um distribution type fiber. The fiber cable must have the following attributes:

- 12/24 individual strands of multimode fiber each must be colour coded for easy identification and all fibers must be packaged within one larger

outer jacket. The fibers must be reinforced with an Aramid yarn for strength.

- The fiber cable must be CMP/CMR rated (FT6/FT4).
- The core must be $50 \text{ um} \pm 3 \text{ um}$.
- The cladding must be $125 \text{ um} \pm 4 \text{ um}$.
- The jacket buffering must be 900 um.
- Numerical Aperture 0.275 ± 0.015 .
- The core cladding offset must be less than 3 um.
- The core non-circularity must less than 6%.
- The cladding non-circularity must less than 2%.

2.4.6 Single Mode Fiber Backbone for Data Applications

Fiber backbone for Data applications may be Single Mode 8/125um distribution type fiber. The fiber cable must have the following attributes:

- 6 minimum (12 preferred) individual strands of Single Mode fiber each must be colour coded for easy identification and all fibers must be packaged within one larger outer jacket. The fibers must be reinforced with an Aramid yarn for strength.
- The fiber cable must be CMP/CMR rated (FT6/FT4).
- The core must be $8 \text{ um} \pm 0.3 \text{ um}$.
- The cladding must be $125 \text{ um} \pm 4 \text{ um}$.
- The jacket buffering must be 900 um.
- The core cladding offset must be less than 3 um.
- The core non-circularity must less than 6%.
- The cladding non-circularity must less than 2%.

2.4.7 UTP Copper Backbone for Data Applications

All vertical 4-pair UTP copper backbone cable between each Telecommunications closet and the Main Telecommunications closet shall be the same product as the horizontal Data Cable. The Project Manager will determine, with the concurrence of the Customer, the UTP copper backbone count between each Telecommunications closet and the Main Telecommunications closet of UTP copper backbone cables to be installed. The UTP copper backbone must be terminated in the same manner as all of the horizontal data cables in the Telecommunications closet (i.e. following the TIA/EIA 568A standard). However, a separate 24 port modular patch panel is to be supplied and installed in each closet for the UTP backbone. All unused modular ports are to be filled with blanks.

2.5 Termination Hardware - Workstation End

2.5.1 UTP Voice and Data Modules

All UTP Voice and Data modules shall be 8-pin RJ45's conforming to the Enhanced Category 5 Standard. The jacks must accept either RJ45 or RJ11 male plugs without causing any damage or degradation to the connectors. They shall have the following minimum performance parameters:

Modular Jack Current rating: 1.5 amperes maximum

Modular Jack Durability: 750 mating cycles

Modular Jack Contact Pressure: 100 grams, minimum per contact

Dielectric Voltage Strength: 1,000V RMS at 60Hz

The UTP modules must be matched appropriately with the Voice and Data Cables to ensure that end to end Vendor Warranties will be applicable. All UTP Data and Voice Cables shall be terminated with the jack colours as described below:

Outlet Module Colour

Data Blue

Voice White (do not split the Voice pairs for termination)

The colours of the UTP modules may be changed at the discretion of the Project Manager.

Outlet Module Position

The orientation of the Data and Voice modules from the perspective of the user is as indicated below:

1st Data Left or Top

Voice Right or Middle

Additional Voice or Data Left or Bottom

The Cabling Contractor must verify, with the Communications Consultant, the position of jacks in surface mounted boxes, wall outlets or flush faceplates prior to installation.

2.5.2 Provide blank filler plates for all unused modular jack positions on faceplates and outlets.

2.6 Termination Hardware - Remote Distribution Terminal

2.6.1 Remote Distribution Terminal (RDT) concept is to be used in areas where access flooring is provided, and also in open office spaces where open systems furniture is expected to be moved or reconfigured routinely.

2.6.2 Provide and install all materials for the installation of Voice/Data bayboxes as described herein.

2.6.3 The bayboxes shall consist of assemblies of the following components:
All Cables are to be terminated on 8 pin UTP modules, inserted into 24/48 port modular patch panels (compatible with standard 19" equipment racks) and placed in communications racks in the Telecommunications Closet for that floor (12/24 ports for voice and 12/24 for data). The 24/48 port modular patch panel should minimise the rack space used, it cannot exceed 3 rack units in height. A total of 12/24 Voice and Data cables are to be connected to the Telecommunications closet from the Remote Distribution Terminal.

2.6.4 Provide an environmentally sealed metal enclosure, complete with hinged lids with neoprene sponge and frame to house and protect the 24/48 port patch panel from dust and/or water hazards.
The metal enclosure shall be constructed with a minimum of 16 gauge galvanized steel, it shall be equipped with feet or offsets to raise the box above the concrete floor. The enclosure shall be complete with a grommeted cable entrance opening, cable tie hole, lamicoïd labels showing baybox zone number and Voice and Data port designations. The enclosures shall be designed to be installed in the ceiling space and/or in access flooring to suit the project requirements.

2.7 Communication Outlets and Accessories

The Cabling Contractor is to allow for the use of single gang Decora Style straps (insert plates), Surface Mounted Boxes or Furniture Adapters interchangeably at the Communications Consultants discretion. There will be no additional charge allowed for the above-described item. The initial intended use of outlets is described below.

2.7.1 Wall Outlets / Floor Boxes

All Data and Voice Cabling that is to be installed using wall outlets / floor boxes (by Division 16) are to use single gang Decora style straps. The colour of the Decora style strap is to be **Ivory**. The Cabling Contractor is to supply and install cover plates for wall outlets. The cover plates are to be single gang (or double gang if required - assume worst case) and they are to match the Decora straps. The Cabling Contractor must **supply and install** all insert plates and cover plates related to Communications Cabling. Each Decora style strap is to have a minimum of 3 positions for communications modules. Each outlet is to be equipped with the appropriate modules as indicated in Section 2.5. Any unused communication positions in wall outlets must 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. The Cabling Contractor is to confirm colours prior to ordering and installing.

2.7.2 Workstation Outlets

All Voice and Data Cabling that is to be installed into furniture must use flush furniture plate(s), **supplied and installed by Cabling Contractor**. If surface mounted boxes are required they must have a minimum of 2 positions (but not more than four). The colour of the surface mount boxes is to be **Black**. Each outlet is to be equipped with the appropriate modules as indicated in Section 2.5. Any unused communication positions in workstation outlets must 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. The Cabling Contractor is to confirm colours prior to ordering and installing.

2.7.3 Dust Covers and Icons

All Communications modules must be installed with Dust Covers and Icons (i.e. Data icon for Data Cable and Voice icon for Voice Cable). In the case where the Dust Cover does not serve as an Icon at a Communication Outlet, an Icon must also be installed. **Any unused communication positions in workstation outlets must be filled with a blank.**

2.7.4 Decora Faceplate Blanks for Wall Outlets

The Cabling Contractor is to **supply and install** Decora Insert plate Blanks and cover plates for unused Communications Cabling wall outlets for up to 10% of the total number of wall outlets (communications) for the project.

2.8 **Termination Hardware - Telecommunications Room(s)**

2.8.1 Horizontal Voice Cables

The Cabling Contractor must design a Voice field (and Data for Scenario B, if required) in accordance with the design criteria of their chosen manufacturer. All Voice Cables are to be terminated on the Backboard (described below) in the Telecommunications Closet for that floor. All cables are to be terminated using IDC (Insulation Displacement Connectors) termination mounts with the ability to terminate a minimum of 60 - 4 pair Voice Cables on termination connectors per mount. The termination connectors must be double sided (one side terminates Horizontal Voice Cable and the other side connects to a cross-connect wire or data 'pigtail'). The termination connectors must be able to terminate 23/24 AWG conductors. The termination mount must be capable of feeding the Voice Cable to the termination connectors from behind the connector. It should be noted that a 6 inch offset Backboard is to be provided by the Cabling Contractor for every floor. All Voice Cables must be fed from behind the backboard to the IDC termination fields. Cable management in the form of Distribution Rings must be provided between columns (2 rings) and rows (2 rings) of IDC mounts to support 'Patch Cord' management.

2.8.2 Horizontal Data Cables (Scenario A)

All Data Cables are to be terminated on 8 pin UTP modules, inserted into 24/48 port modular patch panels (compatible with standard 19" equipment racks) and placed in communications racks in the Telecommunications Closet for that floor. The 24/48 port modular patch panel should minimise the rack space used, it cannot exceed 3 rack units in height.

2.8.3 Horizontal Data Cables (Scenario B)

All horizontal Data cable is to be terminated on the Backboard in the Telecommunications Closet for that floor. All 4 pairs are to be terminated using IDC termination mounts. The termination connectors must be double sided, one side terminates horizontal Data cable and the other side connects to a Data 'pigtail' (described below). The termination connectors must be able to terminate 23/24 AWG conductors. The termination mount must be capable of

feeding horizontal Data cables to the termination connectors from behind the connector. It should be noted that a 6 inch offset Backboard (described below) is to be provided **by the Cabling Contractor**. All horizontal Data cables must be fed from behind the Backboard to the IDC termination fields. Cable management in the form of Distribution Rings must be provided between columns and rows of IDC mounts to support cross-connect wire management. **Voice and Data IDC fields are to be terminated separately. In no case shall the Voice and Data fields be mixed.**

- 2.8.4 Multi-pair Category 3 Backbone Cable for Voice Applications
If required by the Customer, the Cabling Contractor is to **supply and install** multi-pair Category 3 Backbone Cable. The total number of pairs to be supplied and installed is to be determined by the Customer. The Project Manager will determine, with the concurrence of the Customer, the quantity to be installed. All Multi-pair Category 3 Backbone Cable is to be terminated on the Backboard in the Telecommunications Closet for that floor. All pairs are to be terminated using IDC (Insulation Displacement Connectors) termination mounts with the ability to terminate a minimum of 250 pairs of Multi-pair Category 3 Backbone Cable on termination connectors. The termination connectors must be double sided (one side terminates Multi-pair Category 3 Backbone Cable and the other side connects to cross connect wire). The termination connectors must be able to terminate 24 AWG conductors. The termination mount must be capable of feeding the Multi-pair Category 3 Backbone Cable to the termination connectors from behind the connector. It should be noted that a 6 inch offset backboard is to be supplied and installed **by the Cabling Contractor**. All Multi-pair Category 3 Backbone Cable must be fed from behind the backboard to the IDC termination fields. Cable management in the form of Distribution Rings must be provided between columns (2 rings) and rows (2 rings) of IDC mounts to support cross-connect management. **Voice and Data IDC fields are to be terminated separately. In no case shall the Voice and Data fields be mixed.**

- 2.8.5 Fiber Patch Panel(s) (Telecommunications Closet(s))
If required by the Customer, the Cabling Contractor is to **supply and install** Fiber Backbone. The total number of strands to be supplied and installed is to be a minimum of 6, but preferably 12. This is to be determined by the Project Manager. The Project Manager will determine, with the concurrence of the Customer, the quantity and type of fiber to be installed. All Fiber Backbone is to be terminated using a fiber patch panel on a communications rack. The 6/12 strands of fiber, as indicated in Section 2.4, must be installed in the fiber patch panel (compatible with standard 19" equipment racks) and placed in a communications rack in the Telecommunications Closet for that floor. The fiber patch panel should minimise the rack space used, it cannot exceed 3 rack units in height (3U). The fiber patch panel must be serviceable from the front by allowing the fiber patch panel to slide or pivot away from the rack. The fiber patch panels are to be mounted at the upper most position on the racks of each floor. **Low density terminations must be used.** Provide all necessary accessories for a complete fiber patch panel including but not limited; to clear cover plates, mounting brackets and hardware, SC/ST

duplex fiber bulkheads (adapter sleeves-plates/couplers), SC/ST connectors and fiber cable management. The Cabling Contractor is responsible for supplying blank mounting plates for all unused openings.

The 6/12 strands of fiber must be terminated using 62.5/125mm or 50/125mm or 8/125mm SC/ST connectors as is consistent with the fiber being installed. All 6/12 strands are to be terminated at both ends. The terminated fibers must be connected to SC/ST Duplex bulkheads in the fiber patch panels.

The Cabling Contractor is to confirm with the Project Manager the physical fiber optic cabling topology and the type of fiber connectors (SC or ST) to be used on site prior to ordering or installing.

Note: If fiber cabling is being installed, the Cabling Contractor must **supply and install** one additional fiber patch panel for the Main Telecommunications room. This is to include all components described in this Section.

2.9 **Connectivity Items**

2.9.1 Cross Connect Wire (4-pair)

Supply and install Category 3 compliant Cross-Connect Jumper Wire for Voice equipment fields to the distribution fields.

The Cabling Contractor will be required to provide all patching for complete Voice connectivity in the Telecommunications Closet(s). The Cabling Contractor must provide a complete end to end mapping of all connectivity (including horizontal and vertical) at the end of each phase in both hard and soft copy format.

2.9.2 Data Patch Cords (Telecommunications Closet(s) - Scenario A)

The Cabling Contractor shall **supply and install** one Data patch cord per Data outlet on site. The Data patch cords will be 8 pin modular/8 pin modular patch cords. The patch cords are to have 24 AWG **stranded** copper conductors (straight through mapping) consisting of 4 pairs that are twisted to form a cable core. The patch cords are to be CMR rated FT4 and stamped accordingly. The 8 pin modular/8 pin modular patch cords are to be consistent with the grade and manufacturer of the Data Cable that is being Warranted.

The Project Manager shall determine the modular patch cord lengths.

_____ % 2m - Blue

_____ % 3m - Blue

If Channel Performance Warranty requires solid conductors for the patch cords, these must be used to maintain the Warranty.

2.9.3 Data 'Pigtails' (Telecommunications Closet(s) - Scenario B)

The Cabling Contractor shall **supply and install** one Data 'pigtail' per Data outlet on site. The Data 'pigtail' is to be a manufactured pigtail harness of the appropriate length. The Data 'pigtail' will have one end punched down on to the Data field on the Backboard, the remaining male end will be plugged into Customer supplied active equipment.

The Data 'pigtail' lengths shall be such that they reach from the Backboard to the active equipment on the racks without exceeding 5m in length.

Note: The Data 'pigtail' shall have the same specification as standard 8 pin

modular/8 pin modular Line Cords, which are to have 24 AWG **solid** copper conductors (straight through mapping) consisting of 4 pairs that are twisted to form a cable core. The Line Cords are to be CMR rated FT4 and stamped accordingly. The 8 pin modular/8 pin modular Line Cords are to be consistent with the grade and manufacturer of the Data Cable that is being Warranted.

2.9.4 Data Line Cords (Workstations)

Workstation line cords do **not** form part of the scope of this work. However, the Cabling Contractor must supply the required part number(s) to the Customer so that they may order the Data line cords from the Cabling Contractor, if they choose. The part numbers supplied must be such that they maintain the Channel Warranty. Refer to Section 2.9.3 for line cord specification.

2.9.5 Fiber Patch Cords

All Fiber Patch Cords shall be connected to the Customer supplied active equipment using SC/ST duplex zip cords. The Fiber Patch Cords are to be CMR rated FT4 and stamped accordingly. SC/ST duplex zip cords are to be consistent with the grade and manufacturer of the Fiber cable that is being Warranted.

The Cabling Contractor is required to **supply and install** SC/ST duplex zip cords for complete connectivity of all Fiber Cables. The Cabling Contractor must provide a complete mapping of the end to end connectivity at the end of each phase in both hard and soft copy format. The Customer reserves the right to switch the above Fiber Patch Cords connector types to SC/SC, SC/ST or ST/ST configuration at no extra cost, 10 days prior to delivery to site. The Project Manager shall determine the fiber patch cord lengths and quantities to be supplied.

2.10 **Communication Racks**

2.10.1 Communications Racks

All communications racks to be **supplied and installed** for this project are to be free standing, black, 19" floor mounted racks with 44U of rack mounting space. The racks must 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. Each rack supplied must come complete with the following:

Vertical Cable Managers:

Each rack shall come complete with two vertical cable managers installed (one mounted on each side). The vertical cable managers must run the full height of the rack mounting space and provide **6 inches wide x 7 inches deep** of cable management space. The vertical cable manager must have hinged front door(s), back and side cut outs to allow for Patch Cords. It must 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.

Overhead Cable Managers and Chimneys:

Each rack shall come complete with a hinged overhead cable manager installed, dimensions **6 inches wide x 7 inches deep**. 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. At the

right side of **each** rack a cable management chimney must be installed. They must extend from the top of the overhead cable manager to the underside of the ladder tray/ceiling tile above. **The Cabling Contractor is responsible for cutting ceiling tiles as necessary to stub chimney into ceiling space.**

Horizontal Cable Managers

For all racks containing Data Cabling, horizontal cable managers (compatible with standard 19" equipment racks) are to be provided. The horizontal cable managers are to be hinged at the front with vertical access to the patch panel above and below. Each horizontal cable manager is to be 2 rack units (2U) in height. For each rack a total of one horizontal cable manager, per patch panel, is to be supplied plus one additional horizontal cable manager.

Equipment Shelves

Each rack is to be supplied with 1 equipment shelf, this is to be installed at the direction of the Customer. The equipment shelf is to be centre mounted and have a minimum of 18 inches of depth.

Power Bars

Each rack is to come complete with one vertical power bar mounted to the back of the rack on the right hand side. Each power bar is to have 8 outlets, the power cord must reach up to the ladder tray where it will plug into a 15A twist lock receptacle (supplied by others). The power bars are to have 6 foot cords. The power bars are **not** to have reset breakers or an on/off switch. **The power bars must be supplied exactly as stated or the Cabling Contractor will be required to replace them at no charge.**

In all cases racks and components are to be black in colour.

2.11 Miscellaneous Hardware and Materials

2.11.1 Cable Support

Cabling Contractor is to **supply and install** cable support, Caddy Hangers or equivalent (CableCat 12/21/32) and any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal cabling where conduit or cable tray has not been provided. Caddy hangers are to be installed at **3 foot** intervals (maximum). Attaching to any T-bar support rods is not acceptable. Anchors for hangers must not be drilled into post tensioned beams under any circumstances. The size of J-hooks are to suit quantity of cables in runs used for distribution.

2.11.2 Velcro ty-wraps

It should be noted that **only** Velcro ty-wraps are acceptable, under no circumstance are traditional ty-wraps to be used. Velcro ty-wraps are to be used to neatly dress cables; they are to be placed at a maximum of **3 foot** intervals for horizontal distribution.

Velcro ty-wraps are also to be used to dress horizontal cables into racks. For each row of the patch panel cables are to be dressed horizontally (from the middle to the left and the right) to the vertical cable manager (maximum spacing of **3 inches**). Maximum spacing of Velcro for horizontal cables into or along vertical cable managers is to be no more than **6 inches**, this includes cabling dropped from the ladder tray or ceiling above.

2.11.3 Spiral Wrap

Cables running from system furniture feed points to the system furniture shall be neatly wrapped. Match colour of spiral wrap with systems furniture manufacturer's power feed. Spiral wrap to be butted so that no cables are exposed. Size the spiral wrap according to quantity of cables being fed into system furniture. **Split duct style of wrap is not acceptable.**

2.11.4 Inner-Duct

Non plenum rated cables passing through an air plenum must be run through an Inner-duct to a minimum of 6 inches on either side of the plenum space. The Inner-duct must be securely fastened to the wall on either side of the plenum space. **The Inner-duct must be solid and may not be greater than 1 inch in outside diameter.**

All fiber optic cables must be pulled through inner-duct as they exit the EMT conduit system and are routed to the fiber patch panel. The inner-duct must extend the entire length of the fiber. **The Inner-duct must be solid and may not be greater than 1 inch in outside diameter.**

Inner-duct must be used for all fiber optic cable that is pulled through conduits that are 2 inches or greater in diameter.

2.11.5 Backboard (All Telecommunications Closet(s))

Backboards, **supplied and installed by Cabling Contractor**, shall be constructed of 2 - 4' x 8' (3/4 inch) fire rated plywood sheets. Each plywood sheet must be placed vertically and the sheets must be placed immediately adjacent to each other. The backboard shall be mounted on 2 inch x 6 inch studs to offset it from the room wall. The backboard shall also have an 8" removable service panel at the top and the bottom. **The Cabling Contractor will be required to layout the entire backboard field (for themselves and other Contractors) and to drill all holes necessary to run cable from behind the backboard to the front.**

2.11.6 Riser Backboard (All Telecommunications Closet(s))

Riser Backboards, **supplied and installed by Cabling Contractor**, shall be constructed of a minimum of 1 - 4' x 8' (3/4 inch) plywood sheet (or sized to suit location). The plywood sheet should be placed vertically. The backboard is to be painted with 2 coats of white fire retardant paint and mounted directly on the wall.

The Cabling Contractor is to provide cable supports for each cable to securely mount riser backbone cabling to Riser Backboard at maximum 3' intervals.

Note: This backboard is only required if the Customer space covers multiple floors.

2.12 **Labelling**

2.12.1 All labelling shall adhere to CAN/CSA-528, EIA/TIA-606 AND EIA/TIA-568-A guidelines for colour coding

2.12.2 All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition the labels shall meet the general exposure requirements in UL 969 for indoor use.

- 2.12.3 Cable Labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times.
- 2.12.4 All labels must be machine printed using a laser/inkjet printer. Hand-written labels are not permitted.
- 2.12.5 The Cabling Contractor shall **supply and install** 15 additional labels (per floor) of ½ inch lettering height (up to 25 letters each label) for use on cabinets, racks, patch panels or active equipment to be used at the Communications Consultants discretion.

3.0 Part 3: Execution

3.1 General

- 3.1.1 The Project Manager will determine, with the concurrence of the Customer, if the Communications Cabling will be running through plenum or non-plenum spaces. Where the installation is into a plenum space, in part or whole, the Project Manager will specify that FT6 (CMP) rated cables must be used unless they are installed in an end to end EMT conduit system that extends beyond the plenum on both sides. Otherwise, FT4 rated cables will be acceptable.
- 3.1.2 At least one cable will be pulled down and designated for Voice service and one cable for Data service at each communication outlet unless otherwise specified. All cabling will run through office furniture, where necessary, to the point of termination. The Cabling Contractor must terminate and test all cables pulled.
- 3.1.3 All Cables and components to be supplied, installed, tested and terminated in accordance with CSA, ANSI/EIA/TIA-568 and its Amendments as well as UL Guidelines. Particular attention must be given to maintaining the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI.
- 3.1.4 Ensure ANSI/EIA/TIA-568-A installation practices are followed. Cables are to be combed and bundled in a neat and organised manner. The Communications Consultant will determine neatness of the installation. Cables that have not been properly combed and dressed will have to be re-dressed at the Cabling Contractor's expense. The Cabling Contractor shall co-ordinate with the Communications Consultant **prior** to termination in any communications room.
- 3.1.5 The maximum horizontal run length is not to exceed 90-metres. If the 90-metre constraint cannot be met, the Cabling Contractor is to notify the Communications Consultant of any cables that exceed 90-metres, prior to their installation.
- 3.1.6 All cables and pathways such as conduits, cable tray or other systems used for

communication cable distribution to be run parallel or perpendicular to building lines. The Cabling Contractor is to use these where they are available.

- 3.1.7 Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Communications Consultant and documented on as-built drawings.
- 3.1.8 Provide 3.0 m (10'-0") of slack at both ends of each cable to permit future outlet relocation. Neatly coil slack in ceiling space.
- 3.1.9 Utilise all indicated and available cable pathways such as cable tray, conduits, ducts, raceways and furniture system channels except where otherwise noted. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.1.10 Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.

3.2 Installers

- 3.2.1 All Cabling Contractors that have been chosen to participate in this bid are Trained Installers of a single manufactured and Warranted Structured Cabling Platform. All Cabling Contractors must be trained in the proper installation practices of the particular Structured Cabling Platform being quoted. It is not the intent of this document to re-issue the installation requirements but to ensure that the Cabling Contractors comply with these practices.
- 3.2.2 The Cabling Contractor is to adhere to all Standards, regulations and documents listed throughout this document.
- 3.2.3 All products installed must meet or exceed all local, provincial and federal building, fire, health, safety and electrical codes.

3.3 Labour

- 3.3.1 The Cabling Contractor must comply with all job-site requirements for the duration of the project.
- 3.3.2 The Cabling Contractor shall not assign or sub-contract any work without the prior **written consent** of the Customer or his representative. A List of sub-Contractors must be submitted with the tender response.
- 3.3.3 The Cabling Contractor must comply with all requirements of the Occupational Health & Safety Act.
- 3.3.4 The Cabling Contractor agrees to use only tradesmen who are fully trained, qualified and experienced on the installation, termination and testing of the Structured Cabling Platform. The installer must be an approved installer of the

specific cabling system.

3.4 Examination

- 3.4.1 Before acceptance by the Communications Consultant, all the equipment and cabling must be cleaned and tested. At points of termination, all cabling and terminations must be free of any cable pulling lubricants before acceptance by the Communications Consultant.

3.5 Installation

- 3.5.1 All cabling must be terminated using EIA/TIA 568-A configuration, unless specifically noted otherwise.
- 3.5.2 All Data cabling must be bundled **separately** from the Voice Cabling (using Velcro ty-wraps).
- 3.5.3 Supply and install cabling as detailed on floor plan(s). The Cabling Contractor shall use the cable tray (supplied by others) to distribute the cables throughout the facility. Where the cables leave the cable tray and extend to the termination point they shall use the J-hooks specified in this document or conduit provided.
- 3.5.4 Locate racks as shown on contract drawing, anchor racks securely to the floor (all four corners). Bolts/anchors used to mount must be made flush and any sharp edges must be removed. Mount equipment in racks as shown on detail sketches.
- 3.5.5 Ground racks, patch panels, cabinets, Voice cables, metal raceways and Data equipment to building ground busbars (provided by others) using minimum #6 AWG insulated ground wire.
- 3.5.6 Ground cable shall be insulated green jacket, braided copper wire installed in each communication room that connects to the building ground system. Minimum wire size shall be #6 AWG for Telecommunications closets and #1/0 for main building communications room.
- 3.5.7 Grounding system for main building communications room shall be designed such that the individual grounding runs to each piece of equipment does not exceed 5' from the main loop. Grounding to tie into a single ground point only.
- 3.5.8 If any walls on site have security mesh, the Cabling Contractor will be required to install cables through the walls containing security mesh. It is the Cabling Contractors responsibility to **supply and install** an EMT sleeve through the secure wall. The EMT is to extend to a minimum of 4 inches on either side of the security wall. The EMT shall be between 2 and 4 inches in diameter (size to suit) and it must be securely anchored to the slab above. The Cabling Contractor must install sound proof/fire stopping material to re-establish the integrity of the barrier in the wall after all cables have been installed.
- 3.5.9 Neatly bundle and ty-wrap all cables using Velcro ty-wraps. Separate Voice,

Data and fiber cables into separate distinct bundles for identification purposes.

- 3.5.10 When bundling Category 3, Category 5, Enhanced Category 5 or proposed Category 6 cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.
- 3.5.11 Follow proper installation and termination practices for Category 3 and Category 5, Enhanced Category 5 or proposed Category 6 UTP cabling. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as a bend radii if no bend radius is specified by the manufacturer. For fiber optic cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2 inch) whichever is larger for a bend radius.
- 3.5.12 Ground all cables and components to manufacturer's specifications and standard practices.
- 3.5.13 Terminate all pairs of cable. Terminate all spare cables in telecommunication closet and store service point in a neat coil in ceiling space.

3.6 Labelling

- 3.6.1 Labels should be attached to the front of the workstation faceplate, one to the front of the distribution connector/IDC field, and one at each end of the cable (within 4 inches of end). **Cables should also be labelled at the grid point just before the cable coil.**
- 3.6.2 The Cabling Contractor will confirm the proper cable designations with the Communications Consultant prior to installation.
- 3.6.3 The cable labelling scheme for all horizontal cables at both ends shall be as follows:

Horizontal Data Cable Labelling

DaX.z

- D indicates Data.
- a indicates the floor ID (2 digits). Add alphabetical closet identifier for " " " " " "
- X indicates the Telecommunications Closet identifier (A or B) if more " " " " " "
- z indicates the cable number.

Example: D01.05

- D indicates Data.
- 01 indicates the 1st floor.
- 05 indicates the 5th Data cable.

05 indicates the 5th Data cable.

Horizontal Voice Cable Labelling

VaX.z

V indicates Voice.

a indicates the floor ID (2 digits). Add alphabetical closet identifier for multi-closet floors.

X indicates the Telecommunications Closet identifier (A or B) if more than one TC per floor.

z indicates the cable number.

Example: V01.04

V indicates Voice

01 indicates the 1st floor.

04 indicates the 4th Voice cable.

Inter-floor Cable Labelling (Fiber)

C.z

C indicates the originating floor.

z indicates the strand number.

Example: 02.06

02 indicates the 2nd Floor.

06 indicates the 6th strand

Inter-floor Cable Labelling (UTP Copper Backbone)

IF indicates Inter-floor Cabling.

a indicates the originatin floor.

z indicates the cable number.

Example: IF.04.06

IF indicates Inter-floor Cabling.

04 indicates the 4th Floor.

06 indicates the 6th cable

Inter-Building Cable Labelling (UTP Fiber Backbone)

IBF indicates Inter-Building Fiber Cabling.

z indicates the strand number.

Example IBF.06

IBF indicates Inter-Building Fiber Cabling.

06 indicates the 6th strand.

Inter-Building Cable Labelling (UTP Copper Backbone)

IBC indicates Inter-Building Copper Cabling.

z indicates the pair number.

Example: IBC.100

IBF indicates Inter-Building Fibre Cabling.

100 indicates the 100th pair.

3.7 Working Drawing and Documents

- 3.7.1 Where the word 'HOLD' appears on Drawings and other Contract Documents, the work is included in the Contract. Execute the work only after verification of dimensions and materials and obtain Communications Consultant's written permission to proceed.

3.8 Special Techniques

- 3.8.1 Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Cabling Contractor without any additional compensation shall replace damaged cables.
- 3.8.2 Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.
- 3.8.3 Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables.
- 3.8.4 When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2 inch) for Category 5, Enhanced Category 5 and proposed Category 6 cables and 25 mm (1 inch) for Category 3 cables.
- 3.8.5 Apply manufacturer's recommended lubricant to cables to reduce friction between the cable and the duct.
- 3.8.6 Cable grip to be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibers. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

- 3.8.7 Station personnel at each access point (i.e. Handhole, manhole, etc.) to observe and lubricate the cables being pulled.
- 3.8.8 Cable passing through manholes to have sufficient slack for expansion/contraction and to be mounted with clips to prevent sagging.
- 3.8.9 Do not exceed the copper/fiber cables maximum tensile rating during installation. Monitor tension of the cable during installation.
- 3.8.10 Minimum bend radius to be as per manufacturer's recommendations.

3.9 Co-ordination with Other Work

- 3.9.1 Carefully examine work and Drawings of all related trades and thoroughly plan the work so as to avoid conflict or interference with other services. Report defects that would adversely affect work. Do not commence installation until defects have been corrected.
- 3.9.2 Co-ordinate work of this Contract such that items will properly interface with the work of other Contracts. Prepare installation drawings of critical locations and submit to Communications Consultant for review.
- 3.9.3 Cables cannot at any point rest on acoustic ceiling grid panels, lighting, mechanical devices or supports. The Cabling Contractor shall install horizontal cable in such a manner to ensure the EMI/RFI separation distances are maintained.
- 3.9.4 Cables in the ceiling shall be installed above sprinkler systems, and shall not rest on or obscure any valves, fire alarm cables, or other mechanical or control devices.

3.10 Duct and Conduit

- 3.10.1 Clean out each section of duct by pulling a steel wire brush and mandrel of the correct size through the duct before pulling cables.
- 3.10.2 When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Communications Consultant of the problems encountered.
- 3.10.3 Pull cables in underground duct banks in continuous length, splicing of any kind will not be permitted. Pull cables in bottom ducts first, leaving top ducts for future use.

3.11 Site Tolerances

- 3.11.1 To minimise any possibilities of disruption maintain the following minimum clearances from electrical and heat sources when routing cables.

Item

**Minimum
Clearance**

Motor	1.2 m (4'-0")
Transformers	1.2 m (4'-0")
Conduit and cables used for electrical distribution less than 1kV	0.3 m (1'-0")
Conduit and cables used for electrical distribution greater than 1kV	1.0 m (3'-0")
Fluorescent Luminaries	12 cm (0'-5")
Pipes (gas, oil, water, etc.)	30 cm (1'-0")
HVAC (equipment, ducts, etc.)	15 cm (0'-6")

3.12 Repair and Restoration

- 3.12.1 It is the responsibility of the Cabling Contractor to perform all cutting, patching and repair related to the communications cabling work.
- 3.12.2 Any damages to ceiling tiles during the installation of any work described in this document will be the responsibility of the Cabling Contractor. Damages include chipping, breaking or fingerprints. Final decisions on the trade responsible for any damage to ceiling tiles will be made by the Project Manager.
- 3.12.3 If there are full height walls of any type, the Cabling Contractor will be required to install cables through the full height wall as installed by building Contractors. It is the Cabling Contractors responsibility to create an opening through every wall required to pass Voice/Data cables through. It is the Cabling Contractors responsibility to install the sound proof/fire stopping material to re-establish the integrity of the wall sound barrier. The maximum opening size is to be 3" x 3". Cables cannot be passed between the deck pan and the top of a wall unless there is a 3" x 3" opening.

3.13 Field Quality Control

- 3.13.1 Submit tension pull calculation for installation of cables to Communications Consultant.
- 3.13.2 Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension specifications during installation. The tension limit shall be set at or below the manufacturer's limit. The cable to be taken up at intermediate pulling points with an intermediate take-up device as approved by the Communications Consultant, to prevent over tension on the cable.

3.14 Site Tests and Inspection

- 3.14.1 The Customer prior to the commencement of all field-testing may perform a visual inspection. The installation will be validated for compliance with the

industry Standards with particular attention given to the following criteria:

- Cable jacket removal and connector termination.
- Routing and pathway supports.
- Cable bend radius and cable tie slack.
- Neatness, clamping, and harnessing of cabling and wiring.
- Wire and cable identification and labelling.
- Nameplates, identification, plates, and markings.

- 3.14.2 The Communications Consultant must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.
- 3.14.3 The Cabling Contractor is required to submit a soft copy of test results in Excel, Access, Paradox or any other ODBC compatible Database formats.
- 3.14.4 The Cabling Contractor is to use a Level III tester that is capable of testing the specified cable to the performance level(s) indicated in this document. The tester is to use the latest version of firmware and software to test the UTP cabling system and an Optical Loss test set for all fiber optic testing. Acceptable portable UTP test manufacturers include: HP/Agilent Wiresope 350, Microtest OMNIScanner and Fluke DSP-4000.
- 3.14.5 Test patch cords to portable tester must be designed for testing by the manufacturer. Field assembled patch cords are not acceptable. Field testers must use the appropriate jack/tester adapter specified for use with the cabling jack(s) specified within this document.
- 3.14.6 The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. Portable tester to be calibrated on a minimum annual basis.
- 3.14.7 Testing of all horizontal cables is to be completed in accordance with the following test criteria. The testing must be completed on the Channel Level. Testing is to be completed from both ends of the installed cable. Cables specified in this document are to be tested according to the applicable standards.
Testing of the cabling must conform to the following Standards:
Category 3: ANSI/EIA/TIA TSB-67
Category 5: Proposed TSB95 (Draft 11 - April 9, 1999)
Category 5e: EIA/TIA-568-A-5 'Transmission Performance Specifications for 4-
Category 6: Proposed Category 6 Standard 'Transmission Performance

(May 26, 1999)

Testing of all 4 pairs of the horizontal cable (as specified in this document) is to include but not be limited to the following:

1. Wire Map including; end to end continuity, open and shorts, pair polarity
2. Cable length
3. Attenuation
4. NEXT/FEXT
5. ACR
6. Return Loss
7. ELFEXT, PSELFEXT
8. Propagation Delay, Delay skew
9. PSNEXT, PSACR.

All of the above parameters must be recorded and included in the test results.

3.14.8 Test each strand of fiber with an Optical Time Domain Reflectometer for length and attenuation. Performance test must be below the total return loss budget for the cable connectors. Provide comprehensive optical time domain reflectometry (OTDR) testing for fiber runs greater than half a kilometre. Include a hard copy chart recording with the test documentation. Acceptable portable fiber test instruments include: EXFO, Fotec, Laser Precision and FOTO KINETICS.

3.14.9 Test each strand of fiber with a Power Meter / Light Source combination operating at wavelengths of 850 nm and 1300 nm for multimode fibers and 1310 nm and 1550 nm for single mode fibers. Perform these tests in both directions. These test are to be completed after cable installation, splicing and connectors are installed. Tabulate and include test results with test documentation.

Wavelength	Maximum Attenuation	Minimum Bandwidth
850 nm	3.75 dB/km	160 MHz - km
1300 nm	1.5 dB/km	500 MHz - km
1310 nm	0.8 dB/km	n/a
1550 nm	0.5 dB/km	n/a

3.14.10 Cabling Contractor to produce a test report based on the cable schedules. The report should indicate for each cable the values of all measured parameters, when it was tested successfully and the signature of the technician that performed the test, location, cable type, cable number and tester make and

model. A copy of the test report must be submitted to the Consultants for approval. The entire report must be signed by an authorised person for the Cabling Contractor at the end of the project.

- 3.14.11 Correct all cable faults. Splicing of any cables will not be permitted, for any reason, unless prior authorisation is received in writing from the Communications Consultant.

3.15 Cleaning

- 3.15.1 The Cabling Contractor is responsible for keeping the workplace clean, safe and free from debris at all times. All debris must be removed from the site on a daily basis. The costs for cleaning are the responsibility of the Cabling Contractor.

3.16 Demonstration

- 3.16.1 Upon completion of the testing by the Cabling Contractor the Communications Consultant may ask the Cabling Contractor to perform a random re-test of up to 10% of the cables. A penalty of \$50.00 will be deducted from the Contract amount for each cable that fails to pass the random test.

3.17 Protection

- 3.17.1 Following the installation of all cables, all duct entrances into the building to be sealed with duct sealing compound to prevent ingress of moisture, foreign material and rodents.
- 3.17.2 Protect exposed cable ends from moisture ingress.

3.18 Schedules

- 3.18.1 All work is to be performed during normal working hours when possible. Some work will be permitted after hours and on weekends, or only at certain times of the year, upon Customer approval.
Security clearance must be obtained before commencement of work. **Many Government locations deal with highly sensitive information and/or have a requirement to ensure that anyone working on that Site has a security clearance at the proper level.** The Cabling Contractor shall obtain the consent of any such individual for the Government to conduct a security check. The results of this check will be communicated directly back to the individual who will then be able to inform their management of the results of the check. In no case may an individual work at designated sensitive Sites without this security clearance being performed.

3.19 Cut Over Support

- 3.19.1 **The Cabling Contractor is to allow for 2 technicians (up to 8 hours each; regular or after-hours) to be on-site for Cut Over support for each phase.** The Communications Consultant will identify in advance of each Cut Over how

many technicians are required on which day(s). The technicians must be available to provide services to the Customer as required. This may involve additional testing, relocation or pulling down/up of cables or other tasks as required.

3.20 Fire Stopping

- 3.20.1 Follow the criteria set by ULC Standard CAN4-S115 for fire stopping requirements. The Cabling Contractor must establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed.
- 3.20.2 Cabling Contractor must adhere to the fire rating classifications (F, FH, FT, FTH, and H).
- 3.20.3 Supply and install non-permanent CSA approved intumescent fire stopping, to cap all empty sleeves and around cabling passing through sleeves or walls. All fire stopping must maintain a minimum one hour rating and must meet applicable Federal, Provincial and Local building/fire codes.

3.21 Floor Plans and Sketches

- 3.21.1 The Customer will provide the Cabling Contractor with floor plans and sketches as required to complete the project. The Cabling Contractor is review in detail with the Customer all drawings and sketches provided to ensure the intent of the Customer is understood.
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