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COMMUNICATIONS SPECIFICATION

PROJECT NAME:

TORONTO EMERGENCY MANAGEMENT

703 DON MILLS ROAD

TORONTO, ON

OUR PROJECT NUMBER:

91002.010.D.001

DATE:

2026-07-24

ISSUED FOR:

TENDER

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END OF SECTION

27 00 05.10 General Instructions for Telecommunications Sections

1. General

1.1. OVERVIEW

- 1.1.1. Conform to the requirements of Divisions 0 and 1, which apply to and form part of all sections of the work.
- 1.1.2. In the event of a conflict between Divisions 0 or Division 1 sections and information contained in Sections 27 00 05.10 - GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS, 27 00 05.60 – ADMINISTRATIVE REQUIREMENTS, and 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS of this document, the more stringent, onerous, and/or costly requirement shall apply.
- 1.1.3. Read and comply with all sections of this document.
- 1.1.4. Provide all labour, materials, tools, and equipment required for the complete scope of the Work specified in all sections of the Contract Documents.

1.2. SECTIONS AFFECTED

- 1.2.1. These instructions apply to and form a part of all Telecommunications Sections.

1.3. INTENT

- 1.3.1. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
- 1.3.2. Be completely responsible for the acceptable condition and operation of all systems, equipment, and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment, and repair related damages. The replacement of equipment and repair to damages shall be coordinated with other trades completed in a timely fashion so as not to affect the complete construction of the Telecommunications Systems and/or work by others.

1.4. WORK INCLUDED

- 1.4.1. Provide a new Telecommunications Structured Cabling system for the area included in the scope of this Contract. The Structured Cabling Systems shall be as follows:
 - .1 Decommission and remove all existing redundant cabling and equipment as indicated on Drawings.
 - .2 Reuse existing cabling and equipment where indicated on the Drawings.
 - .3 Horizontal Structured Cabling System consisting of 4-pair Copper Cabling for data applications.
- 1.4.2. All horizontal cabling shall be serviced from the nearest logical Telecommunications Room, either existing or new as shown on floor plans.
- 1.4.3. The Telecommunications Structured Cabling system is based on a physical star wiring topology (unless otherwise specified) that is designed in accordance with and supported by a manufacturer backed certification and warranty as specified herein. This cabling infrastructure solution shall encompass, and not be limited to, all telecommunication outlets, cable, cable terminating hardware, equipment cabinets/racks, and selected connectivity devices.

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- 1.4.4. Provide CMP (FT6) rated components of the Telecommunications Cabling System that is to be located within spaces deemed a Return Air Plenum. CMR (FT4) rated components may be used in spaces upon approval by all Authorities Having Jurisdiction (AHJ) and/or the Telecommunications Engineer's Representative. For this project, all components shall have a CMP (FT6) rating unless otherwise specified in this document. All CMP (FT6) rated products must be CSA/ULC.
- 1.4.5. While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and that any part numbers identified are correct, it is the responsibility of the Telecommunications Contractor to verify all part numbers and to report any errors and/or omissions in the Drawings and/or Specification during the procurement process.
- 1.4.6. Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurements.
- 1.4.7. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- 1.4.8. Include all labour, materials, plant, transportation, storage costs, training, equipment, insurance, temporary protection, permits, inspections, bonding, taxes, and all necessary and related items required to provide complete and operational systems shown and described.
- 1.5. BIDDER INQUIRIES
- 1.5.1. Bidders who find discrepancies or omissions in this RFQ, or who have any doubt as to the technical meaning or intent of any part of this RFQ, shall direct their questions or other inquiries in writing to the Telecommunication's Engineer's Representative as defined in Section 27 00 05.20 – DEFINITIONS AND ABBREVIATIONS
- 1.5.2. In fairness to all bidders, all questions will be answered and distributed to all. Oral questions will not be answered. No questions will be answered within 48 hours of the closing date / hour of the bid. Refer to Division 0 for question period close time and date.
- 1.6. TENDER FORMS AND SUBMISSION OF TENDERS
- 1.6.1. Submit all information called for on the Telecommunications Tender and Supplementary Tender Forms. Tenders not completed in full may, at the discretion of the Owner, be rejected.
- 1.6.2. Show separate, identified, alternate and unit prices for optional components or items called for as additions to or deductions from the Tender amount.
- 1.6.3. The Owner reserves the right to accept or reject any substitution without question.
- 1.6.4. Include incidental fees and other fees for items required to successfully install the Structured Cabling Solution that may or may not be indicated in this document. Meet all requirements of this document and all telecommunications (and related) standards, municipal, local, Provincial and Federal building, safety, fire and electrical codes.
- 1.7. HOLDBACK
- 1.7.1. The value for testing and documentation (cable test results and as-builts), for payment purposes, shall be set at 10% of the base contract or \$5,000; which ever is greater. This amount will be withheld from the Telecommunications Contractor until testing and correction of deficiencies is 100% complete.

1.8. SCHEDULE

- 1.8.1. By submitting a response to this document and associated Drawings, the Telecommunications Contractor agrees to meet and adhere to all project milestones as indicated in the project schedule(s).
- 1.8.2. Acknowledge that project schedule(s) are subject to change. Verify all project milestones with the Telecommunications Engineer's Representative and/or General Contractor.

1.9. LABOUR

- 1.9.1. Comply with all job-site requirements for the duration of the project.
- 1.9.2. Do not assign or sub-contract any Work without the prior written consent of the Telecommunications Engineer's Representative. In the event of sub-contractor approval, submit a complete list of sub-contractors during the procurement process.
- 1.9.3. Use only workers who are fully trained, qualified, and experienced on the installation, termination, and testing of the Structured Cabling Solution.
- 1.9.4. Third party certification will not be permitted unless the certifying contractor performs the termination and testing for all cabling. If third party certification is necessary, the Telecommunications Contractor shall obtain the consent of the Telecommunications Engineer's Representative prior to submitting a bid response.
- 1.9.5. Make any changes or alterations required by an authorized inspector of the authority having jurisdiction.
- 1.9.6. Obtain consent from the Telecommunications Engineer's Representative before changing the Project Manager and/or Site Supervisor during the Project.

1.10. ACCESS AND PROTECTION

- 1.10.1. Access to the Site shall be limited to location and time of day. Refer to Section 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS and conform to requirements.
- 1.10.2. Refer to the security and protection requirements in the General Conditions and conform to all requirements.

1.11. DRAWINGS, CHANGES AND INSTALLATION

- 1.11.1. The Drawings are intended to show the general character and scope of the Work and not the exact details of the Work. Complete the Work with all accessories required for a complete and operative installation.
- 1.11.2. The location, arrangement, and connection of equipment and material as shown on the Drawings represent a close approximation to the intent and requirements of the contract. The Telecommunications Engineer's Representative reserves the right to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no extra cost to the Owner.
- 1.11.3. Certain details indicated on the Drawings are general in nature and specific labelled detail references to each occurrence of use is not indicated, however, such details shall be applicable to every occurrence on the Drawings.
- 1.11.4. The location and size of existing services shown on the Drawings are based on the best available information. Verify the actual location of existing services in the field before Work is commenced.
- 1.11.5. Make changes and modifications necessary to ensure co-ordination and to avoid interference and/or conflicts with other trades, or to accommodate existing conditions, at no extra cost to the Owner.

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- 1.11.6. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.11.7. Where equipment is shown to be 'roughed in only', obtain accurate information from the Telecommunications Engineer's Representative before proceeding with the Work.
- 1.11.8. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers, and all other equipment shown on Drawings (if shown) is diagrammatic.
- 1.11.9. Remedy any Work not installed in correct location (at the sole discretion of the Telecommunications Engineer's Representative). The Telecommunications Contractor is responsible to mark-out their Work and fully co-ordinate with all other trades. Review the Work with Telecommunications Engineer's Representative prior to rough in.
- 1.12. APPROVED EQUAL
- 1.12.1. Wherever the term "approved equal", "approved equivalent", or another variation is used herein, it is to be understood that reference to the specified trade name, brand name, manufacturer's name, model number, and catalog number has been made solely to indicate the minimum standard of quality required in material, workmanship, and service. Any proposed alternate shall be submitted for review and acceptance before procurement and installation. The review and acceptance shall be at the sole discretion of the Owner and the Telecommunications Engineer's Representatives.
- 1.13. CONFLICTING REQUIREMENTS
- 1.13.1. In the case of conflict or discrepancy in the requirements indicated in the contract documents the more stringent, onerous, and/or costly requirement shall apply.
- 1.14. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS
- 1.14.1. Materials and equipment provided under this Division shall be new and free from defects.
- 1.14.2. All equipment and material for which there is a listing service shall bear a ULC and/or CSA label.
- 1.14.3. Equipment shall meet all applicable FCC/CRTC Regulations.
- 1.14.4. Materials shall have a flame spread in accordance with local Authorities Having Jurisdiction, and in accordance with the Specifications of this project.
- 1.15. DOCUMENT FORMAT
- 1.15.1. This document has been constructed based on a 3-part specification for Division 27. The first part 'General' describes general information pertaining to the section. The second part 'Product' describes the products that shall be provided for the project. The third part 'Execution' details the requirements for the installation of the specified products. Reference sections 1 and 3 for the relevant General information and Execution requirements of products that are listed in section 2.
- 1.16. STATEMENT OF PRICES
- 1.16.1. Submit a statement of their estimated prices for the various portions of the Work including both labour and materials to form a basis of progress payments. The total price of all portions of the Work shall equal the total price of the Work covered under the Telecommunications Division.

1.17. VALUATION OF CHANGES

- 1.17.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:
- .1 Estimate and acceptance in a lump sum, unless the Telecommunications Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.
- 1.17.2. Provide the Telecommunications Engineer's Representative with a detailed cost analysis of the contemplated change indicating:
- .1 Quantity of each material.
 - .2 Unit cost of each material.
 - .3 Time involved.
 - .4 Sub-trade quotations including a complete analysis of costs.
 - .5 Mark-ups, if applicable.
 - .6 Value of GST or HST, as applicable.
 - .7 Proposed change in Contract Time.
- 1.17.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.
- 1.17.4. The following shall not be included in the cost of the Work but are covered by the hourly rate:
- .1 The Contractor's payroll, administrative, head office and site office expenses, including stationary, postage and other office supplies.
 - .2 The costs of the Telecommunications Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
 - .3 Use of temporary offices, sheds, small / hand tools, storage, site office consumables, etc., including but not limited to the cost of telephone, light, power, water and heat used therein.
 - .4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.
 - .5 Insurance premiums, all government payroll burdens, variable labour factors and union or association funds.
 - .6 Licenses and permits, except when these are special for a particular item of Work.
 - .7 Printing charges for Proposed Changes, Change Orders and Drawings for the Contractor's and Subcontractors use in the Work. Telecommunications Engineer's Representative will provide one PDF copy of change notice documentation.
 - .8 The cost of preparing As-Built drawings, layout drawings, working drawings and Shop Drawings. This includes any and all AutoCAD / BIM (or other method) costs related to interference drawings or other associated drawings that may be required as part of the changes.
 - .9 The cost of cleanup and disposal of waste material.
 - .10 Parking, travel, coffee breaks, rest periods, warranties, safety training, WHMIS and health and safety committee, and non-productive time.
 - .11 Rentals, additional bonding, project financing.
- 1.17.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-[latest version] GC 6.2.

- 1.17.6. Inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the Work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.
- 1.17.7. Charge special equipment rental rates at cost. Submit the invoice for special equipment rental with the cost of the Work.
- 1.17.8. The maximum percentage fee for mark-ups shall be as stated in the Division 0/1 specifications or the Contract Supplementary Conditions.
- 1.17.9. All changes, change notices, revisions to contract, site instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.
- 1.17.10. Labour Rate:
 - .1 For the duration of the contract, extra Work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour unit's column 1 (one). No additional factors will be accepted.
 - .2 The hourly labour rate for all changes will be based on a Journeyperson rate as listed on the Supplementary Bid Form. The Owner and/or Telecommunications Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, mark-up, and profit. The labour rate will be inclusive of all labour burden charges as stated in this 'Valuation of Changes' section above.
 - .3 The following labour burdens are not part of the hourly labour cost and are covered under overhead and mark-up or under the NECA labour unit rates: safety measures and regulations, drawings and specifications study, layout, measuring and marking the installation locations, material unloading jobsite storage and delivery to the installation area, inspection, uncrating and shipping support removal, tool-acquisition and return to storage, clean-up of excess material.
 - .4 Submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate comprising the proposed hourly rate. The Owner and the Telecommunications Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.
- 1.17.11. When pricing additional work for Proposed Changes, the Telecommunications Contractor shall only price new materials that are required for the Proposed Change. Where existing materials and / or infrastructure (i.e. roughed-in cables) can be re-used for the Proposed Change, the Telecommunications Contractor shall utilize these items in the valuation of the Change at no extra cost.
- 1.17.12. Where a Proposed Change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.
- 1.17.13. When pricing Proposed Changes containing both additions and credits, and where no work and / or materials have been installed on site, the Electrical Contractor shall only price the net new materials and net new labour that are required for the Proposed Change. Per unit labour and material costs shall be equal for credits and additions.

PROPOSED CHANGE ORDER

Company Name:	CCN #
Address:	Date:
City, Prov.:	Project Name:
Postal Code:	Project Number:
	Quote Number:
Telephone:	Change Order #:
Fax:	
E-Mail address:	
Owner Address:	

Work Description

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

Itemized Breakdown

<u>Description</u>	<u>Qty.</u>	<u>Net Price U</u>	<u>Total Mat(\$)</u>	<u>Labor U</u>	<u>Total Hours</u>
4-Pair Category Cable		\$X.XX C		\$X.XX C	
Termination Module		\$X.XX C		\$X.XX C	
Patch Cord		\$X.XX C		\$X.XX C	
Modular Patch Panel		\$X.XX C		\$X.XX C	
Labelling		\$X.XX C		\$X.XX C	
Testing		\$X.XX C		\$X.XX C	
TOTALS					

Summary

<u>Description</u>	<u>Total Hours</u>
General Materials	\$Y.YY
Material Total	
JOURNEYPerson (xx Hrs. @ \$xx.00)	
Subtotal	
MARK-UP	
Overhead/Mark-up (@ 5.000 %)	
Profit (@ 5.000%)	
Total Mark-up	
Final Amount (TNIP)	

2. Products

2.1. NOT USED.

3. Execution

3.1. SITE EXAMINATION

- 3.1.1. Prior to submitting their tender response, perform a site survey (when available) to familiarise their workers with the site and all conditions of the site affected by the proposed Work. No claims for extra payment will be considered because of failure to fulfil this condition.

END OF SECTION

27 00 05.20 Definitions and Abbreviations

1. General

1.1. DEFINITIONS

1.1.1. Generally, the following definitions are used in this Division:

Addendum	- Normative document used to provide additional requirements and recommendations to a published document (e.g., standards, contracts). When published, an addendum effectively becomes part of the document that it supports.
Basic Link	- The Basic Link configuration consists of a maximum of 90 meters (295 ft) of uninterrupted solid-copper twisted-pair cable with a termination connection on each end.
Bonding	- The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.
Bonding Conductor (BC)	- A conductor used specifically for the purpose of bonding.
Building Entrance Facility	- The room or space inside a building where telecommunications cables enter and leave the building.
Category	- A rating that defines the performance of cabling components and systems. Describes mechanical properties and transmission characteristics of balanced twisted-pair cabling and provides a numbered designation.
Channel	- Complete end to end connection including patch cords, cable and termination device(s).
Cut Over	- The live date(s) when the Owner will occupy the space as indicated by date and/or phasing.
Demolish	- Detach existing items and legally dispose of them off site.
Drawings	- Details, diagrams, layouts, schedules, and other information in a design drawing package accompanying this specification.
Grounded Conductor	- A system or circuit conductor that is intentionally grounded.

Grounding System	- A system of hardware and wiring that provides an electrical path from a specified location to an earth ground point.
Modular Copper Patch Panel	- A patch panel that allows each RJ-45 female jack (or port) to be removed individually.
Owner	- Person or company that will own the system and components.
Permanent Link	- The Permanent Link is a Basic Link that has been tested to the applicable cabling performance for the relevant standard.
Project	- Supply and installation of a complete Structured Cabling Solution to support Voice, Data and/or Video applications as described in this document.
Provide	- Supply, install, test, configure, and document.
Shop Drawings	- Contractor provided construction drawings to facilitate compliance with the plans and specifications.
Telecommunications Contractor	- The successful bidder to this Specification responsible for the supply and installation of the Structured Cabling Solution as detailed in this document and associated Drawings.
Telecommunications Engineer's Representative	- Joshua Blizzard Smith + Andersen 1100 - 100 Sheppard Avenue East, Toronto, ON - M2N 6N5
Telecommunications Outlet	- A fixed connecting device where the horizontal cable terminates that provides the interface to the work area cabling and is typically found on the floor, wall, ceiling or on furniture.
Work Area	- Work area (WA) components extend from the telecommunications outlet/connector end of the horizontal cabling system to the WA equipment.
Workstation	- Systems Furniture Workstation, Office, Meeting Room, Boardroom, Classroom, etc. Any Voice or Data cable originating in a Telecom, LAN, Computer Room or Consolidation Point that is not terminated on a patch panel / IDC Block at the other end.

1.2. ABBREVIATIONS

1.2.1. Generally, the following abbreviations are used in this Division:

A - Ampere

ac	- Alternating current
ACR	- Attenuation to Cross-Talk Ratio
ADC	- Analog to Digital Converter
ADSL	- Asymmetric Digital Subscriber Line
A/E	- Architect or Engineer
AFF	- Above Finished Floor
AHJ	- Authority Having Jurisdiction
ALPETH	- Aluminum Polyethylene
AME	- Architectural, Mechanical, Electrical
AN	- Access Node
ANSI	- American National Standards Institute
AP	- Access Point
ARPAP	- Resin-coated Aluminum, Polyethylene Aluminum, Polyethylene
ASCII	- American Standard Code for Information Interchange
ASP	- Aluminum Steel Polyethylene
ASTM	- American Society for Testing and Materials
ATD	- Asynchronous Time Division
ATDM	- Asynchronous Time Division Multiplexing
ATM	- Asynchronous Transfer Mode
Attn	- Attenuation
AV	- Audiovisual
AWG	- American Wire Gauge
BAS	- Building Automation System
BC	- Bonding Conductor
BCD	- Backbone Conduit
BCT	- Bonding Conductor for Telecommunications
BEF	- Building Entrance Facility
BER	- Bit Error Rate
BERT	- Bit Error Rate Test

BFOC	- Bayonet Fibre Optic Connector
BIC	- Building Industry Consultant
BICSI®	- Building Industry Consulting Service International
bit	- Binary Digit
BOM	- Bill Of Material
b/s	- Bit per Second
BWA	- Broadband Wireless Access
CA	- Cable
CACSP	- Coated Aluminum Coated Steel Polyethylene
CAD	- Computer Aided Design
CATV	- Community Antenna Television (Cable Television)
CCIA	- Computer Communications Industry Association
CCTV	- Closed Circuit Television
CD	- Compact Disc
CEC	- Canadian Electrical Code
CEF	- Cable Entrance Facility
CENELEC	- European Committee for Electrotechnical Standardization
cm	- Centimetre
CMP	- Communications Plenum
CMR	- Communications Riser
coax	- Coaxial Cable
CO-OSP	- Customer-Owned Outside Equipment
CP	- Consolidation Point
CPU	- Central Processing Unit
CPVC	- Chlorinated Polyvinyl Chloride
CRTC	- Canadian Radio-television Telecommunications Commission
CSA	- Canadian Standards Institute
CSC	- Construction Specifications Canada
CSI	- Construction Specifications Institute

CT	- Cable Tray
Cu	- Copper
dB	- Decibel
dB/km	- Decibel per Kilometre
dBm	- Decibel milliwatt
dBmV	- Decibel millivolt
demarc	- Demarcation Point
D-ring	- Distribution Ring
DID	- Direct Inward Dialing
DSL	- Digital Subscriber Line
EF	- Entrance Facility
EIA	- Electronics Industry Alliance
ELFEXT	- Equal Level Far-End Crosstalk
e-mail	- Electronic Mail
EMI	- Electromagnetic Interference
EMI/RFI	- Electromagnetic Interference / Radio Frequency Interference
ER	- Equipment Room
ESD	- Electrostatic Discharge
ETL	- Edison Testing Laboratories
e/w	- Equipped With
FC	- Fibre Connector
FCC	- Federal Communications Commission
FDDI	- Fibre Distributed Data Interface
FEP	- Fluorinated Ethylene Propylene
FEXT	- Far-End Crosstalk
FOTP	- Fibre Optic Test Procedure
ft	- Foot / Feet
ft2	- Square Foot / Feet
FTTD	- Fibre To The Desk

FT 1 / FT 3	- Fractional T 1 / Fractional T 3
G	- Giga
Gb	- Gigabit
GB	- Gigabyte
Gb/s	- Gigabit per Second
GC	- General Contractor
GHz	- Gigahertz
GWB	- Gypsum Wall Board
HC	Horizontal Cross-connect
Hz	- Hertz
I	- Current
IC	- Intermediate Closet
IC	- Intermediate Cross-connect
ID	- Identification
ID	- Inside Diameter
IDC	- Insulation Displacement Connection
IDC	- Insulation Displacement Connector
IDC	- Insulation Displacement Contact
IDF	- Intermediate Distribution Frame
IEEE®	- Institute of Electrical and Electronics Engineers, Inc. ®
IG	- Isolated Ground
in	- Inch
in ²	- Square Inch
I/O	- Input / Output (Device)
ICEA	- Insulated Cable Engineers Association
IEC	- International Electrotechnical Commission
IOR	- Index Of Refraction
ISDN	- Integrated Services Digital Network
ISO	- International Organization for Standardization

IT	- Information Technology
kb	- Kilobit
kB	- Kilobyte
kg	- Kilogram
Km	- Kilometre
kV	- Kilovolt
kVA	- Kilovoltampere
kW	- Kilowatt
kWh	- Kilowatt hour
LAN	- Local Area Network
laser	- Light Amplification by Stimulated Emission of Radiation
lb	- Pound
LED	- Light Emitting Diode
LEN	- Local Exchange Node
LSZH	- Low Smoke Zero Halogen
m	- Metre
m ²	- Square Metre
mA	- Milliampere
MAC	- Move, Add, or Change
MAN	- Metropolitan Area Network
Mb	- Megabit
MB	- Megabyte
Mb/s	- Megabit per Second
MB/s	- Megabyte per Second
MC	- Main Cross-connect
MDF	- Main Distribution Frame
MGB	- Main Grounding Busbar
MHz	- Megahertz
mi	- Mile

MIMS	- Mineral Insulated Metal Sheathed
min	- Minute
mm	- Millimetre
MM	- Multimode
MMF	- Multimode Fibre
MPP	- Modular Patch Panel
ms	- Millisecond
MSDS	- Material Safety Data Sheet
MUTO	- Multi-user Telecommunications Outlet
MUTOA	- Multi-user Telecommunications Outlet Assembly
mW	- Milliwatt
MW	- Megawatt
NBCC	- National Building Code of Canada
NESC	- National Electrical Safety Code
NEXT	- Near-end Crosstalk
NIC	- Network Interface Card
NIR	- Near-end crosstalk-to-Insertion loss Ratio
NRCC	- National Research Council of Canada
OD	- Outside Diameter
ODBC	- Open Database Connectivity
OEM	- Original Equipment Manufacturer
OF	- Optical Fibre
OSP	- Outside Plant
PBX	- Private Branch Exchange
PDU	- Power Distribution Unit
PSACR	- Power Sum Attenuation to Crosstalk Ratio
PSSELFEXT	- Power Sum Equal Level Far-End Crosstalk
PSNEXT	- Power Sum Near-End Crosstalk
PVC	- Polyvinyl Chloride

QA	- Quality Assurance
QC	- Quality Control
QoS	- Quality of Service
RCDD®	- Registered Communications Distribution Designer
RF	- Radio Frequency
RFI	- Radio Frequency Interference
RFQ	Request for Quote
RJ	- Registered Jack
rms	- Root Mean Square
RU	- Rack Unit (1.75")
RX	- Receive
RX	- Receiver
SAN	- Storage Access Network
SC	- Single Fibre Coupling Optical Fibre Connector
SCC	- Standards Council of Canada
SCS	- Structured Cabling System
ScTP	- Screened Twisted Pair
SFTP	- Screened Foiled Twisted Pair
SI	- International System of Units (Le Système International d'Unités)
SLA	- Service level Agreement
SM	- Singlemode
SMF	- Singlemode Fibre
SNMP	- Simple Network Management Protocol
SNR	- Signal-to-Noise Ratio
STALPETH	- Steel Aluminum Polyethylene
STP	- Shielded Twisted Pair
STP-A	- Shielded Twisted Pair A
T 1	- Trunk Level 1
TBB	- Telecommunications Bonding Backbone

TBBIBC	- Telecommunications Bonding Backbone Interconnecting Bonding Conductor
TC	- Telecommunications Closet
TDD	- Telecommunications Device for the Deaf
TGB	- Telecommunications Grounding Busbar
TGR	- Telecommunications Grounding Rod
TIA	- Telecommunications Industry Association
TMGB	- Telecommunications Main Grounding Busbar
TN	- Telecommunications Node
TP	- Twisted Pair
TR	- Telecommunications Room
TS	- Technical Standard
TSB	- Telecommunications Systems Bulletin (formerly Technical Systems Bulletin)
TTY	- Teletypewriter / Text Telephone
TV	- Television
TX	- Transmit
TX	- Transmitter
UD	- Underfloor Duct
UL®	- Underwriters Laboratories Inc.®
ULC	- Underwriters Laboratories of Canada
UPC	- Universal Product Code
UPS	- Uninterruptible Power Supply
UTP	- Unshielded Twisted Pair
V	- Volt
VA	- Volt-Ampere
VCSEL	- Vertical Cavity Surface Emitting Laser
VLAN	- Virtual Local Area Network
VoIP	- Voice over Internet Protocol
VPN	- Virtual Private Network

W	- Watt
WAN	- Wide Area Network
WAP	- Wireless Application Protocol
WiFi	- Wireless Fidelity
Wi-Fi	- Wireless Fidelity
WLAN	- Wireless Local Area Network
WMAN	- Wireless Metropolitan Area Network
WWAN	- Wireless Wide Area Network
X	- Cross-connect
XLPE	- Cross-linked Polyethylene
XPE-PVC	- Expanded Polyethylene Polyvinyl Chloride

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

27 00 05.30 Codes, Standards and Regulations

1. General

1.1.1. Code, Standard and Regulation Compliances

- .1 The Telecommunications Contractor shall adhere to all Codes, Standards, Regulations and documents listed throughout this document.
- .2 All products installed must meet or exceed all Local, Provincial and Federal Building, Fire, Health, Safety and Electrical Codes.
- .3 The non-plenum/plenum cable shall be ETL or ULC Listed and CSA Certified as type CMR/CMP, in accordance with the Binational Standard for Telecommunications Cable, UL444/C22.2 No. 214-17.
- .4 The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards and Regulations of Authorities Having Jurisdiction as indicated in Table 1. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.
- .5 Table 1: Applicable Codes, Standards and Regulations

STANDARD	TITLE
ANSI/ICEA	
S-80-576	Communication Cables.
S-83-596	Optical Fibre Premises Distribution Cable, latest version
S-104-696	Standard for Indoor-Outdoor Optical Cable, latest version
Z136.2	American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources.
ANSI/TIA	
455	Standard Test Procedures for Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components – latest version
472CAAA-93	Detail Specification for All-Dielectric (Construction 1) Optical Fibre Communications Cable for Indoor Plenum Use, Containing Class Ia, 62.5 mm Core Diameter/125 Cladding Diameter Optical Fibre(s).
492AAAB-09	Detail Specification for 50.0-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
526-14	Optical Power Loss Measurement of Installed Multimode Fibre Cable Plant; Modification of IEC 61280-4-1 edition 2, Fibre-Optic Communications Subsystem Test Procedures – Part 4-1: Installed Cable Plant-Multimode Attenuation Measurement
568.0	Generic Telecommunications Cabling for Customer Premises, latest version.

568.1	Commercial Building Telecommunications Infrastructure Standard, latest version.
568.2	Balanced Twisted Pair Telecommunications Cabling and Component Standard, latest version.
568.3	Optical Fibre Cabling Components Standard, latest version.
569	Commercial Building Standard for Telecommunications Pathways and Spaces including all addenda, latest version
598	Optical Fibre Cable Colour Coding, latest version
604-5	FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO, latest version.
606	Administration Standard for Telecommunications Infrastructure, latest version.
607	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, latest version.
942	Telecommunications Infrastructure Standard for Data Centers
CSA	
C22.1	Canadian Electrical Code Part I: Safety Standards for Electrical Installations, latest version.
C22.2 No. 41	Grounding & Bonding Equipment
C22.2 No. 182.4-M90	Plugs, Receptacles, and Connectors for Communication Systems, latest version.
C22.2 No. 214-17	Communications Cables.
CAN/CSA-C22.2 No. 0-10	General Requirements, Canadian Electrical Code, Part II (latest version)
OTHER	
CAN/ULC-S115	Standard Method of Fire Tests of Firestop Systems, latest version.
CAN/ULC S101	Standard Method of Fire Endurance Tests of Building Construction and Materials, latest version.
CAN/ULC S102	Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies, latest version.
CENELEC EN 50173	Information Technology – Generic Cabling Systems Part 1: General Requirements, latest version
CLC	Canada Labour Code, Part II Occupational Health and Safety, and Provincial and Local Health and Safety regulations
IEC 60603-7	Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors, latest version.

ISO/IEC IS 11801-1	Information Technology - Generic Cabling for Customer Premises – Part 1: General Requirements, latest version.
NEMA WC 63.1	Performance Standard for Twisted Pair Premise Voice and Data Communications Cable, latest version.
RoHS	Restriction of Hazardous Substances Directive 2011/65/EU, latest version

- .6 Comply with all Local, Provincial and Federal codes for fire and electrical, as well as all local 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, at no extra charge to the Owner.

1.1.2. General Installation Requirements

- .1 Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment, apparatus and installation of systems cabling solution furnished into premises. Remove these items from premises when no longer required.

1.1.3. Metric Conversions

- .1 Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, equipment, material, and site services in both new and existing installations.

1.1.4. Cutting, Patching and Repairing

- .1 Perform all cutting, patching, repairing, and making good related to the Telecommunications Cabling Work including any penetrations through walls or floors.
.2 Allow for all costs associated with cutting, patching, repair, and making good related to the Telecommunications Work including any penetrations through walls or floors.
.3 Paint all visible Telecommunications conduit to match existing.
.4 Coordinate the colour and location of all conduits, devices, and their housing with architect and architectural drawings on-site before installation.

2. Products

2.1. NOT USED

3. Execution

3.1. CODE, STANDARD AND REGULATION COMPLIANCES

- 3.1.1. Install and terminate all cables and components in accordance with CSA, the latest edition of ANSI/TIA-568 and its Amendments as well as UL/ULC Guidelines. Maintain 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.
3.1.2. Comb and bundle all cables in a neat and organised manner. The Telecommunications Engineer's Representative will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Telecommunications Contractor's expense. Coordinate with the Telecommunications Engineer's Representative prior to re-dressing cables.

- 3.1.3. The maximum horizontal run length for 4-pair cabling shall not exceed 90-metres. If the 90-metre constraint cannot be met, notify the Telecommunications Engineer's Representative of any cables that exceed 90-metres, prior to installation.

END OF SECTION

27 00 05.50 Contract Documents

1. General

1.1. CONTRACT DOCUMENTS

1.1.1. Read and complete the Telecommunications Tender forms.

1.1.2. All Contract Documents, including all General Conditions, Division 1 Specification Sections (if present) and Instructions to Bidders apply to this section and all other Specification sections.

1.2. WORK INCLUDED

1.2.1. Drawings List

- .1 Refer to the drawing list in the Telecommunications Drawings for a list of drawings that shall be used for preparation of bids and construction.

2. Products

2.1. NOT USED

3. Execution

3.1. COORDINATION

3.1.1. Carefully examine Work and Drawings of all related trades and thoroughly plan the Work to avoid conflict or interference with other services. Report defects that would adversely affect Work. Do not commence installation until defects have been corrected. Beginning the Work constitutes acceptance of conditions as satisfactory.

3.1.2. Co-ordinate the Work of this Contract such that items will properly interface with the Work of other trades. Prepare installation drawings of critical locations and submit to the Telecommunications Engineer's Representative for review.

END OF SECTION

27 00 05.60 Administrative Requirements

1. General

1.1. PROJECT CLOSEOUT SUBMITTALS

1.1.1. Project closeout submittals shall include:

- .1 Table of contents
- .2 As-built drawings
- .3 Cable Test Results
- .4 Warranty Letters
- .5 Manufacturer Certification
- .6 Fibre Optic Safety Letter

1.2. WORK INCLUDED

1.2.1. Closeout Submittal – As-built Drawings

- .1 Prepare drawing(s) to clearly mark all changes and deviations during the construction process, including the pathway of the cables from the Telecom Room(s) to the Workstations or between Telecom Rooms. Drawing(s) shall be kept up-to-date during construction and in addition to field measurements shall include field instructions and all other changes. Include all additional cables installed during the project in the as-built drawings.
- .2 The Telecommunications Engineer's Representative has the right to review the status of the as-built drawing(s) from time to time during the construction process. On completion of the project, submit to the Telecommunications Engineer's Representative a soft copy of as-built drawings indicating all such changes and deviations for review within five (5) business days of the completion of the project.
- .3 Request (in writing) from the Telecommunications Engineer's Representative a soft copy of the Drawings for use by the Telecommunications Contractor in preparation for as-built Drawings. Update the soft copy drawing(s) with correct as-built information (i.e. cable numbers, outlet locations, rack/backboard elevations, etc.) in digital format using the most current version of the Drawings native format (e.g.: AutoCAD or Revit).
- .4 All changes to drawing(s) shall follow conventional Engineering Draft Standards. All outlet locations shall be identified with proper designation.
- .5 If the Telecommunications Contractor cannot comply with this requirement, Smith + Andersen will transfer all hand drawn as-builts to the Drawing's native format (AutoCAD or Revit) at a cost to the Telecommunications Contractor. The cost for this service shall be based on per diem rates at time of completion.
- .6 Print / plot two sets of as-built Drawings at no extra cost. Final as-built print(s)/plot(s) must not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.) and shall be delivered to the Owner.
- .7 The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) are provided.

1.2.2. Closeout Submittal – Cable Test Results

- .1 Produce a test report based on the cable schedules. The report shall indicate for each cable, when it was tested successfully and the signature of the technician that performed the test.

- .2 An authorized person certified with the Manufacturer for the Telecommunications Contractor must sign the entire report. Supply one (1) soft copy in the tester's native format, along with the appropriate software to read the test results.
 - .3 The project will remain incomplete and a holdback will be retained until satisfactory cable test results are provided.
 - .4 Provide testing and commissioning documentation for all items and their related components to the Telecommunications Engineer's Representative prior to the completion of the project or at the Telecommunications Engineer's Representatives request. Include maintenance manuals and operating instructions for Owner's staff use.
- 1.2.3. Closeout Submittal – Warranty
- .1 Provide a minimum of a 1-year unconditional parts and labour Warranty for all equipment and labour provisioned under this contract, from the date of substantial performance of the contract, for each Telecommunications cabling system.
 - .2 Response time for Warranty items shall be 24 hours. Repair deficient Cabling Solution components outside regular working hours. Bidders shall include a statement of Warranty terms and conditions with their contract documents.
- 1.2.4. Closeout Submittal – Manufacturer Certification
- .1 Arrange for a minimum of 25-year Manufacturer's Warranty and System Performance Guarantee, from the date of substantial performance of the contract, for each Telecommunications cabling system.
 - .2 Provide a manufacturer Warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer Specifications.
 - .3 Upon request and at no additional cost to the Owner the Telecommunications Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.
 - .4 All documentation including the certificate must be in English and French, and shall be submitted to the Telecommunications Engineer's Representative for signed acceptance prior to their production.
- 1.2.5. Closeout Submittal – Fibre Optic Safety Letter
- .1 Prepare a letter confirming safety labels have been provided at all required locations, and that they will meet performance requirements.
 - .2 Refer to section 27 05 53.00 – IDENTIFICATION FOR COMMUNICATIONS SYSTEMS for location and maintenance requirements.
- 1.2.6. Project Submittal – Shop Drawings
- .1 Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared.
 - .2 Prepare specifically for this project each Shop Drawing for non-catalogue items. Clearly mark Shop Drawings and brochures for catalogue items to show what is being supplied.
 - .3 Stamp and sign each Shop Drawing or catalogue sheet shall to indicate the drawing has been checked by the Telecommunications Contractor for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that co-ordination is complete before submitting Shop Drawings for review.

- .4 Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.
 - .5 When requested, supplement Shop Drawings by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.
 - .6 Provide space for Shop Drawing review stamps for the Telecommunications Contractor and Telecommunications Engineer's Representative. This space shall be clear of all technical information and shall not be on the back of any sheets.
 - .7 One original Shop Drawing will be returned. All copies required for the trades, suppliers or other Consultants will be printed by the Telecommunications Contractor.
- 1.2.7. Project Submittal – Permits, License Reviews and Fees
- .1 Where materials are specified which require special review and approval of CSA and/or local Authorities Having Jurisdiction, obtain such approval for the particular installation with the co-operation of the material supplier. Obtain and pay for permits and reviews required for Work performed.
 - .2 Submit required Documents and Shop Drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Drawings and Specifications may be used for this purpose. Prepare any additional information, details and Drawings these authorities may require.
- 1.2.8. Project Submittal – Substitutions and Alternate Products
- .1 This document specifies the use of a complete end-to-end Structured Cabling Solution as manufactured, warranted and certified by a single manufacturer. Alternate materials (from the overall cabling solution) will not be accepted unless specifically noted.
 - .2 Where supply of the materials may compromise the schedule, submit a request to use alternate product to the Telecommunications Engineer's Representative. Depending on the circumstance, the Telecommunications Engineer's Representative may provide written authorisation to substitute the Product. Obtain written authorization before providing alternates.
 - .3 Where a separate price is requested in this document, prepare quotation(s) to install/provide products and/or systems as outlined. Submit the separate price quotation with the bid response. Instructions and products requested under separate price sections shall not be considered substitutions or alternate products.
 - .4 The Telecommunications Engineer's Representative's decision regarding the acceptance or rejection of the proposed substitution is final. Substitutions may be accepted if the delivery of the component or item is such that it will not jeopardise the construction schedule. Otherwise, the substitution may not be approved.
 - .5 In order to be assessed, proposed substitutions must include the following:
 - .1 Description of proposed substitution,
 - .2 Respective cost of items originally specified and the proposed solution,
 - .3 Compliance with the applicable Building Codes and the requirements of Authorities Having Jurisdiction,
 - .4 Compliance with the applicable Telecommunications standards,
 - .5 Affect concerning compatibility with and interface with adjacent building materials and components,
 - .6 Compliance with the intent of the Contract Documents, and
 - .7 Reason(s) for the request.

- .6 Substitution submissions do not relieve the Telecommunications Contractor from the obligation of preparing and submitting a contract documents that is in complete compliance with this specification document and associated Drawings. Any substitution submissions must be clearly outlined in addition to the original specified equipment as detailed in this document and associated Drawings as a separate or alternate price format.
- 1.2.9. Project Submittal – Scheduling
 - .1 Within one week of award of the contract, submit a formal project schedule to the Telecommunications Engineer's Representative showing start and finish dates of major tasks as denoted by system such as: demolition, backbone cabling, horizontal cabling, rack and cabinet installation, material order and delivery to site and testing.
 - .2 Submit updated schedules as periodically requested by Telecommunications Engineer's Representative.
- 1.2.10. Project Submittal – Review and Testing Requirements
 - .1 Develop and submit a test plan indicating the process and types of tests to be performed. The plan must indicate the testing process for each cable.
 - .2 The Telecommunications Engineer's Representative must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.
 - .3 Invite the Telecommunications Engineer's Representative to witness field testing a minimum of five (5) business days before testing commences.
 - .4 Upon completion of the testing the Telecommunications Engineer's Representative may request a random test of up to 10% of the links. The Telecommunications Contractor shall test these randomly selected links and the results shall be stored in accordance with this document. The results obtained shall be compared to the original test data. A penalty of \$50.00 shall be deducted from the Contract amount for each cable that fails to pass the random test. If more than 2% of the sample results differ in terms of the pass/fail determination, repeat 100% testing under the supervision of the Telecommunications Engineer's Representative. The cost of the labour required for the testing as well as the cost for the supervision by the part of Telecommunications Engineer's Representative shall be borne by the Telecommunications Contractor.
- 1.2.11. Keep the site and surrounding area clean, safe and free from debris at all times. Remove all debris from the site on a daily basis. The costs for cleaning are the responsibility of the Telecommunications Contractor.
- 1.2.12. Upon completion of the Work and before acceptance and final payment will be made, clean and remove from the site, all surplus and discarded materials, temporary structures and debris of every kind. Surplus and waste materials removed from the site shall be disposed of in accordance with applicable laws and regulations.
- 1.2.13. Before acceptance by the Telecommunications Engineer's Representative, all the equipment and cabling must be cleaned and tested.

2. Products

2.1. NOT USED.

3. Execution

3.1. NOT USED.

END OF SECTION

27 00 05.70 Project Specific Requirements

1. General

1.1. WORK INCLUDED

1.1.1. Cable Installation

- .1 The Telecommunications Contractor may assume at their own risk that the entire cable installation will be done during regular hours, except:
 - .1 Where noted otherwise in this specification;
 - .2 As outlined in the project front end documents.

1.1.2. Floor/Ceiling Tiles

- .1 Remove and re-install all floor/ceiling tiles in areas affected by the Work. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise, remove and re-install the tiles after the Work is complete.
- .2 Any damage to ceiling tiles during the installation of any Work described in this document is the responsibility of the Telecommunications Contractor. Damages include chipping, breaking and/or soiling. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Owner and/or the Telecommunications Engineer's Representative.
- .3 The Telecommunications Contractor shall be responsible for storage and protection of floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.1.3. Cut Over Planning and Management

- .1 Include for a total of 16 hours cut over support, to be used at the discretion of the Owner/Telecommunications Engineer's Representative. The technician shall be available to provide services to the Owner as required. This may involve additional testing or Move, Add, Change (MAC) activity. Any additional materials used shall be addressed separately.
- .2 Schedule installers such that the cut over schedule is maintained. Any shift work or overtime premiums that are required to complete the project on schedule shall be included in the Telecommunications Contractor's contract Price.

1.1.4. Safety of Persons and Property

- .1 Comply with all laws, ordinances, rules, regulations, and policies of the Owner and lawful orders of any public Authority Having Jurisdiction for safety of persons or property or to protect them from damage, injury or loss.
- .2 Moderate public pedestrian traffic should be expected around all Work locations. Ladders scaffold, installation materials, and all other hazardous conditions shall be fully protected at all times. Warning cones, signs, barricades and warning tapes shall be used to warn and protect persons and property at all times in public corridors.
- .3 Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection stand pipes, hydrants and exit stairs shall be maintained at all times.
- .4 Maintain at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes and junction boxes.
- .5 No open flames/smoking shall be permitted without prior written approval of the Owner.
- .6 Set up and remove all signage and safety measures to ensure that other trades and non-trade personnel are safe from work of the Telecommunications Contractor.

-
- 1.1.5. Access to Site
- .1 Coordinate site access with the Project Manager and/or Owner as determined during the initial project meeting.
- 1.1.6. Identification
- .1 All Telecommunications Contractor personnel shall be clearly identified by either uniform or company ID. The Telecommunications Contractor may also be required to wear Owner provided ID for required card access locations or identification. All Owner ID(s) must be returned daily or at the end of the project as determined by the Owner.
- 1.1.7. Emergency Facilities
- .1 The Telecommunications Contractor shall maintain at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes and junction boxes.
- 1.1.8. Product Delivery Requirements
- .1 Be responsible for complete delivery, handling, and installation of all materials used in the performance of the Work.
 - .2 Arrange for the delivery of Owner furnished equipment/materials related to the Specifications or Drawings and related items, including unloading of supplier's truck, elevator scheduling, storage, and placement on as indicated on Contract Drawings.
- 1.1.9. Product and Tools Storage Requirements
- .1 Be responsible for storage and handling of all materials used in the performance of the Work.
 - .2 Job boxes may be allowed to be stored on the site during construction. The tools and the job box shall be the responsibility of the Telecommunications Contractor. The Owner and their representative shall be in no way responsible or liable for any tools of the Telecommunications Contractor.
- 1.1.10. Confined Spaces
- .1 Where Work is performed in a confined space, comply with all code related and Owner specific safety requirements.
- 1.1.11. Coordination with Occupants
- .1 Be responsible for co-ordinating all Work with the Owner/tenant of the floor space for their daily work.
- 1.1.12. Project Meetings
- .1 Attend site meetings when requested by the Telecommunications Engineer's Representative and/or the Project Manager. Regular meetings may occur once per week at the Telecommunications Engineer's Representative's and/or the Project Manager's discretion.
 - .2 Attend scheduled project meetings throughout the duration of the project to review the status of current and planned activities, schedule and conduct other business associated with the project.
- 1.1.13. Progress Reports
- .1 Prepare and issue a status report at the scheduled project meeting including status of: progress, project completion for phases, material ordering and delays.

2. Products

2.1. NOT USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. Unload materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

3.2.1. The Telecommunications Contractor shall be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until project cut over. Any damage to equipment shall be the liability of the Telecommunications Contractor. All damage shall be repaired, or at the Owner's request, the equipment shall be replaced at no extra charge to the Owner.

END OF SECTION

27 00 06.00 Fire Stopping and Water Proofing

1. General

1.1. WORK INCLUDED

1.1.1. Fire Stopping

- .1 Provide seals in all Fire Rated Separations and Firewalls to form tight barriers to retard the passage of flame and smoke.
- .2 The installed seals shall provide and maintain the fire resistance rating of the adjacent floor, wall or other fire separation assembly in accordance with Fire Code and Building Code requirements.
- .3 Establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed, or that were created by others for use by the Telecommunications Contractor.
- .4 Provide Fire Stop pillows for existing cable tray penetrations through firewalls.
- .5 For the purposes of this specification, the only acceptable Fire Stop Systems shall be those that have been tested to the CAN/ULC S115 Standard.
- .6 Provide non-permanent CSA approved Fire Stop systems that are dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required).
- .7 All fire stopping shall maintain a minimum one-hour rating and shall meet applicable Federal, Provincial and Local building codes.
- .8 All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the Standards.
- .9 Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.
- .10 All Smoke Seals selected for use shall comply with Fire Code, Building Code, and Building Standards.
- .11 All Fire Stop Materials and Smoke Seals shall have elastomeric characteristics to allow for building settling and seismic movement. All Fire Stop Materials and Smoke Seals shall be free of asbestos.

1.1.2. Water Proofing

- .1 Seal all foundation penetrating conduits and service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.
- .2 Seal or reseal all service entrance conduits through building upon cable placement. Plug spare conduits with expandable plugs.

1.1.3. Quality Assurance

- .1 Provide fire stopping systems that comply with the following requirements following:
 - .1 Fire stopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for fire stop system acceptable to authorities having jurisdiction.
 - .2 Fire stopping products bear the classification marking of qualified testing and inspection agency.

- .2 Provide the Work of this Section using competent installers, experienced in the application of the materials and systems being used, approved and trained by the material or system manufacturer.
- .3 Fire Stop Systems shall conform to the fire (F), hose (H) and temperature (T) ratings of Codes.
- .4 Fire Stop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").
- .5 For the purposes of this specification the only acceptable Fire Stop Systems are those that have been tested to the CAN/ULC S115 Standard.

1.1.4. Performance

- .1 Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.
- .2 Where non-mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.
- .3 Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.
- .4 Seal openings for cable trays using re-enterable fire stopping pillows.

1.1.5. Project Conditions

- .1 Do not install fire stopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer
- .2 Do not install fire stopping products when substrates are wet due to rain, frost, condensation, or other causes.
- .3 Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.
- .4 Do not use materials that contain flammable solvents.
- .5 Coordinate construction of openings and penetrating items to ensure that through-penetration fire stop systems are installed according to specified requirements.
- .6 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.
- .7 Schedule installation of fire stopping after completion of penetrating item installation but prior to covering or concealing of openings.

2. Products

2.1. GENERAL

- 2.1.1. Use only fire stopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.2. MANUFACTURERS

- 2.2.1. Products manufactured by Hilti Corporation (or approved equivalent) are acceptable.

- 2.2.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.
- 2.3. MATERIALS
- 2.3.1. Firestop Sealants: The following products are acceptable.
- .1 Hilti FS-ONE MAX high performance Intumescent Firestop Sealant
 - .2 Hilti CP 601S Elastomeric Firestop Sealant.
 - .3 Hilti CP 606 Flexible Firestop Sealant
 - .4 Hilti CP 604 Self-Leveling Firestop Sealant
 - .5 Or equivalent
- 2.3.2. Cast-In Firestop Device: A one-step cast-in firestop device for a variety of pipe materials and diameters. The following product is acceptable.
- .1 Hilti CP 680-M Cast-in Firestop Device or equivalent.
- 2.3.3. Firestop Putty: An intumescent, non-hardening, firestop putty for cable and pipe penetrations. The following product is acceptable:
- .1 Hilti CP 618 Firestop Putty Stick or equivalent.
- 2.3.4. Firestop Plug: Ready-to-use intumescent and reusable plug for small openings. The following product is acceptable:
- .1 Hilti CFS-PL Firestop Plug or equivalent.
- 2.3.5. Fire Rated Cable Pathways: Re-penetrable cable management device:
- .1 Hilti CP 653 Speed Sleeve or equivalent.
3. Execution
- 3.1. FIRE STOPPING
- 3.1.1. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of fire stopping in accordance with manufacturer's installation instructions and technical information.
- 3.1.2. Examine sizes and conditions of voids to be filled to establish correct thickness and installation of Fire Stop Materials.
- 3.1.3. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- 3.1.4. Prepare surfaces in contact with Fire Stop Systems and Smoke Seals to manufacturer's instructions. Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- 3.1.5. Install/replace sound barrier/fire stopping materials as soon as cables have been pulled through the opening.
- 3.1.6. In all Fire Stop Systems that require mineral wool or ceramic fibre backer or filler materials, these materials shall be dry and free of other contaminants before, during and after installation of sealant Fire Stop Materials. Alkaline water contamination of the backer or filler materials may cause corrosion of metallic penetrating items.
- 3.1.7. Apply Fire Stop Systems and Smoke Seals in strict accordance with manufacturer's instructions to prevent the passage of fire and smoke, and where required and / or specifically designated, the passage of fluids.

- 3.1.8. Provide temporary forming and packing as required. Tool or trowel all exposed surfaces to smooth, neat and tidy finish.
- 3.1.9. Fire Stop and smoke seal gaps and holes in all Fire Separation and Firewall construction through which cables pass as a result of Work in this document.
- 3.1.10. In Combustible Construction (membrane GWB type) where the framing members are wood or where paper faced insulation is incorporated within the separation, a Fire and Temperature rise "FT" rating is required equal to that of the rating of the Fire Separation. Include openings which have been formed and sleeved.
- 3.2. WATER PROOFING
 - 3.2.1. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or water proof duct seal.
- 3.3. EXPOSED SERVICE PENETRATIONS IN CEILING OF UNDERGROUND PARKING AREAS
 - 3.3.1. Where the bottom of a Fire Stop System is exposed, seal bottom side of the assembly with a fire rated elastomeric Fire Stop sealant.
- 3.4. CLEAN UP
 - 3.4.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of the Telecommunications Engineer's Representative. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION

27 00 07.10 Cable and Equipment Removal

1. General

1.1. WORK INCLUDED

1.1.1. Labour Allowance

- .1 Allow for cable removal in the contract, based on the scope of Work indicated in this section and on any associated demolition Drawings.
- .2 Confirm with the Telecommunications Engineer's Representative prior to any cable being removed. Forward a schedule indicating the locations and times for cable removal to the Telecommunications Engineer's Representative.
- .3 In occupied areas where there is no hoarding, remove and re-install ceiling tiles on a per shift basis unless directed otherwise by the Owner.

1.1.2. Cable and Equipment Removal

- .1 Include the extent of demolition work in the contract which is delineated in demolition Drawings and associated detail Drawings.
- .2 Where identified on drawings, remove cable and equipment only within specified areas; otherwise, cable and equipment removal area in scope shall encompass the entire floor(s).
- .3 Co-ordinate all Work with the current use of the building(s).
- .4 Maintain all Telecommunications services to all parts of the building which are to remain in use. Schedule all Work and inform the owner in writing at least one week in advance for permission of any necessary shutdowns or outages indicating proposed time(s) and duration(s) of interruptions.
- .5 Consult with the owner and determine the equipment required to be online 24 hours per day and provide temporary services and wiring as necessary. Reschedule Work accordingly when requested by the project manager and/or owner.
- .6 Include the cost of premium time in the contract for Work during nights, weekends, holidays, or other time outside normal working hours necessary to maintain all Telecommunications services in operation.
- .7 Scope of Demolition:
 - .1 Include removal, relocation and reinstallation of Telecommunications devices/systems/infrastructures in the areas noted on the Drawings. This shall include, but is not limited to:
 - .1 Disconnection, removal and/or reinstallation of all Telecommunications devices/systems/infrastructures to accommodate new Work. Refer to relevant electrical, architectural, structural, mechanical, and other project design Drawings to determine exact scope of work.
 - .2 All Work and material disposal shall be done in accordance with the established schedule and general conditions.
 - .3 All services passing through the area of Work, but servicing other areas of the building shall be identified, protected and left in place, unless otherwise noted.
 - .4 Disconnect and remove all existing services, devices and wiring materials which are abandoned.

- .5 Trace and identify all Telecommunications devices/systems/infrastructure for review by the Telecommunications Engineer's Representative and/or Owner in order to determine if services are to remain or to be removed. Once identified, the Telecommunications Contractor must remove those as directed.
- .8 Disposal of Materials
 - .1 Dispose of all material removed from the site in accordance with all applicable environmental legislation and regulations and as noted elsewhere in the specifications.
 - .2 Separate and recycle materials to be disposed to the maximum extent possible.
- .9 Hazardous Materials
 - .1 If at any time during course of Work hazardous materials are encountered or suspected, cease Work in area in question and immediately report, in accordance with local regulation on hazardous materials to the project manager.
 - .2 Do not resume Work in affected area without approval from the project manager.
- 2. Products
 - 2.1. NOT USED
- 3. Execution
 - 3.1. CABLE IDENTIFICATION
 - 3.1.1. Prior to removal of Telecommunications cabling, identify all existing non-active cabling (as well as active cabling to remain), and verify the location and extent of removal with the Owner. Tone out cables to ensure the intended cables are demolished.
 - 3.2. REMOVAL OF MATERIALS
 - 3.2.1. Protect all removed (to be retained) equipment from damage. Repair or replace without adjustment to the contract price all existing equipment which is damaged in process of relocation.
 - 3.2.2. Turn over to the Owner all racks, cabinets, accessories, patch panels and voice connectivity hardware. If items are not to be re-used, confirm disposal with the Project Team prior to disposal.
 - 3.2.3. Dispose of on a daily basis all cabling and components that are removed. Include all costs of removal and disposal in the contract price.
 - 3.2.4. No equipment may be burned or sold on site.
 - 3.3. SYSTEMS TO REMAIN
 - 3.3.1. All services and equipment not shown on the Drawings shall be maintained in operation during the construction phase. Provide new wiring for any existing systems to remain so that the existing systems do not interfere with the Work. Remove existing devices and reconnect to new services accordingly.
 - 3.3.2. Maintain operation of all systems outside of the renovated area which may be affected by the renovation.

- 3.3.3. Any device and/or related connectivity which have been made inoperative as a result of this Work but are not in an area to be demolished shall be reactivated at no cost to the Owner.
- 3.3.4. Trace out and catalogue all outlets within the renovated area and adjacent areas. Mark this information on a set of drawing prior to any Work commencing as these devices and/or related connectivity will be reused as part of this work as noted on the Drawings or called for in the contract documents.
- 3.3.5. Clean and test existing equipment/cabling which is to remain and equipment/cabling being reinstalled in areas being renovated for proper operation and repair as necessary before being put back into service.
- 3.3.6. Verify operation of all existing devices and report any discrepancies to the Communications Engineer's Representative and/or Owner prior to proceeding with the Work.
- 3.3.7. Unless noted otherwise provide additional equipment of the same type and manufacturer where required to supplement existing equipment.

- 3.4. INTERFACE WITH EXISTING SYSTEMS
 - 3.4.1. Provide interfacing components between new and existing systems as necessary for proper performance and operation.
 - 3.4.2. Check and coordinate all systems in the renovated area and in the new building addition (if applicable), which are extended to existing systems to ensure their proper operation.

- 3.5. FIRE STOPPING AND WATERPROOFING
 - 3.5.1. As per Section 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS, make good all Fire Stopping and Waterproofing where Fire Stopping and/or Waterproofing has been disturbed during cable removal, or where Fire Stopping and/or Waterproofing was non-existent.

END OF SECTION

27 05 28.00 Pathways for Telecommunications Systems

1. General

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. Use pathways installed by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers.
- 1.1.2. Do not use any mechanical or electrical fittings to support the Telecommunications cabling.
- 1.1.3. Independently support the cables above all ceiling tiles in such a manner that the cables do not interfere with the removal of the ceiling tiles. Maintain a minimum of 75 mm 3"(in) of clear vertical space above the ceiling tiles shall .
- 1.1.4. Obtain the Telecommunications Engineer's Representative approval for all deviations from the contract documents and Drawings in relation to cable routing, outlet and equipment locations.

1.2. INDOOR CABLE DISTRIBUTION

- 1.2.1. Utilise all indicated and available cable pathways such as conduits, Telecommunications cable tray, ducts, surface raceways installed by the Electrical Contractor, and furniture system channels except where otherwise noted.
- 1.2.2. Inside buildings minimize any possibilities of interference by maintaining the following minimum clearances from electrical and heat sources when routing cables.

Item	Minimum Separation Distances		
	(<2kVA)	(2-5kVA)	(>5kVA)
Unshielded power lines or electrical equipment in proximity to open or non-metallic pathway.	127 mm (5"(in))	305 mm (12"(in))	610 mm (24"(in))
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	64 mm (2.5"(in))	152 mm (6"(in))	305 mm (12"(in))
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	---	76 mm (3"(in))	152 mm (6"(in))
Motors	1.2 m (4'-0")		
Transformers	1.2 m (4'-0")		
Fluorescent Luminaires	300 mm (12")		
Pipes (gas, oil, water, etc.)	120 mm (5")		
HVAC (equipment, ducts, etc.)	150 mm (6")		

2. Products

2.1. NON-CONTINUOUS CABLE SUPPORT

- 2.1.1. Supply and install cable support for the distribution of horizontal and backbone cables where conduit or cable tray has not been provided.

- 2.1.2. Use non-continuous cable supports up to the maximum density of cables permitted, as specified by the manufacturer.
- 2.1.3. Provide adequate supports to suit the quantity of cables in runs used for distribution.
- 2.1.4. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.
- 2.1.5. Approved Manufacturers:
- .1 Erico,
 - .2 Panduit, or
 - .3 An equivalent and sized as per manufacturer recommendations.

2.1.6. Approved Products

- .1 Panduit J-Pro, J-Mod, or equivalent cable supports shall be used where ceiling space rating dictates.

Description	Panduit Part#	J-Mod
Wall Mount	JP2W-L20	Equivalent
Ceiling Mount	JP2CMB-L20 SPEC	Equivalent
Drop Wire and Threaded Rod Clip	JP2DW-L20	Equivalent
Screw-On Beam Clamps	JP2SBC50-L20 or JP2SBC50RB-L20	Equivalent
Hammer On Beam Clamps	JP2HBC25RB-L20 or JP2HBC50RB-L20 or JP2HBC75RB-L20	Equivalent
Purlin Clips	JP2ZP-L20 or JP2CP-L20	Equivalent
Under Floor Pedestal Support Clamp	JP2UF100-L20	Equivalent

2.2. VELCRO STRAPS

- 2.2.1. Provide only Velcro straps for bundling of cable. Under no circumstance shall plastic tie-wraps be used.
- 2.2.2. Acceptable Manufacturers
- .1 Panduit: HLS/HLM-15R0 (Black), or
 - .2 Approved equivalent
- 2.2.3. If plastic tie-wraps are used the Telecommunications Contractor shall remove and replace all affected cables at their own expense.

2.3. SPIRAL WRAP

- 2.3.1. Size Spiral Wrap according to quantity of cables being fed into the system furniture. Spiral Wrap colour shall match system furniture manufacturer's power feed.
- 2.3.2. Approved Manufacturers:
- .1 Panduit part number: T50F-CX, or
 - .2 Approved equivalent.

2.4. INNER DUCT

2.4.1. For plenum rated spaces, supply and install plenum rated Inner duct. Carlon part numbers are listed below.

2.4.2. Acceptable manufacturer:

.1	Size	Plenum	Riser
	1"	Carlon Part# CF4X1C XXX	Carlon Part# DF4X1C XXX
	2"	Carlon Part # CJ4X1C XXX	Carlon Part # DJ4X1C XXX

Where "XXX" refers to appropriate product length

2.4.3. Innerduct shall be sized appropriately to maintain the 40% fill ratio and allow for a proper bend radius of the cable(s) within.

2.4.4. Where Innerduct is installed for use with OM1 or OM2 Multimode Fibre, it shall be Orange. Where Inner duct is installed for use with OM3/OM4 Multimode Fibre, it shall be Aqua. Where Inner duct is installed for use with Single Mode Fibre, it shall be Yellow. All Inner duct shall be installed with pre-lubricated pull tape.

3. Execution

3.1. CABLE DISTRIBUTION

3.1.1. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.

3.1.2. Install and terminate all cables and components in accordance with applicable Codes, Standards and Regulations.

3.2. CABLE SUPPORT

3.2.1. Supply and install supports, hanger supports, and any other miscellaneous hardware required to support Telecommunications cabling where conduit/cable tray has not been provided. Any conduit and cable tray shall be provided by the Electrical Contractor as indicated on Division 27 Drawings, unless otherwise noted. Telecommunications Contractor is responsible for determining these requirements based on Telecommunications and/or Electrical Drawings.

3.2.2. Install hangars at 4' intervals (maximum). Do not exceed a cable sag greater than 4". Secure all cables to J-hooks/supports with Velcro straps. Comb and dress cables for all visible portions of the install. Comb and redress any cables that do not meet this criteria at no additional cost.

3.2.3. Run all cable support hangers and inner duct parallel to building lines.

3.2.4. Cable support hangers or hanger supports must not be drilled into post-tensioned beams under any circumstances.

3.2.5. Be responsible for coordinating the best time to install the supports with the General Contractor. After hours Work may be required for this portion of the Work.

3.2.6. Size supports to accommodate the number of cables in each run. Provide other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling.

3.2.7. In the Cable Support Hanger System, each individual run or pathway shall not contain more than fifty (50) UTP horizontal cables. Provide an additional hanger pathway to divide the cable bundle where the quantity exceeds this.

- 3.2.8. Completely and independently support the hangar system from the structural ceiling or walls (concrete slab/deck). Do not support the cable support hanger system from the suspended ceiling. Do not drill anchors for hangers into post tensioned beams under any circumstances. Do not use pneumatic hammers. All anchors must be drilled into slab.
- 3.2.9. Minimize the disturbance or removal of 'fire spray' insulation during installation of cable supports.
- 3.3. VELCRO STRAPS
 - 3.3.1. Use Velcro straps to neatly dress cables; they shall be placed at a maximum of 4' intervals for horizontal distribution (centre points between cable supports).
 - 3.3.2. Use Velcro straps to dress horizontal cables into racks/cabinets. For each row of the patch panel, the maximum spacing of Velcro for horizontal cables into or along vertical cable managers shall be no more than 6", this includes cabling dropped from the ladder tray or ceiling above.
- 3.4. SPIRAL WRAP
 - 3.4.1. Install spiral wrap from system furniture feed points to system furniture entry point. Spiral Wrap shall be butted so that no cables are exposed.
- 3.5. INNERDUCT
 - 3.5.1. Install Fibre Cables in innerduct over the entire length inside the building. Exceptions to this are for:
 - .1 Armoured Fibre cabling; or
 - .2 Where a dedicated fibre conduit is installed that is 1.5" in diameter or less.
 - 3.5.2. Under these situations, the fibre cabling may be installed without inner duct.
 - 3.5.3. Minimise the number of separate innerducts installed by pulling multiple fibre cables through each innerduct.
 - 3.5.4. Inner duct shall be CMR (FT4) or CMP (FT6) rated, as is appropriate for ceiling space classification and local code requirements. Size innerduct to suit installation requirements.
 - 3.5.5. Fasten to the backboard, rack, cabinet, or enclosure by utilizing cradle mounts and plastic permanent cable ties.
- 3.6. CABLE DISTRIBUTION
 - 3.6.1. Ensure ANSI/TIA-568.1, latest edition standard installation practices are followed for indoor cable distribution and ANSI/TIA-758, latest edition standard installation practices are followed for outdoor cable distribution.
 - 3.6.2. Station personnel at each access point (i.e. Handhole, maintenance hole, etc.) to observe the cables being pulled. Submit tension pull calculation for installation of cables to Telecommunications Engineer's Representative.
 - 3.6.3. Do not exceed the Copper/Fibre cables maximum tensile rating during installation. Monitor tension of the cable during installation. Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension Specifications during installation. Set the tension limit at or below the manufacturer's limit. The cable shall be taken up at intermediate pulling points with an intermediate take-up device as approved by the Telecommunications Engineer's Representative, to prevent over tension on the cable.
 - 3.6.4. Do not exceed the minimum bend radius as per the manufacturer's recommendations.

- 3.6.5. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.
- 3.6.6. Protect exposed cable ends from moisture ingress.
- 3.6.7. Provide sufficient slack for cable passing through maintenance holes for expansion/contraction and install clips to prevent sagging.

- 3.7. CABLE LUBRICANT
 - 3.7.1. The use of pulling lubricants of any kind is strictly prohibited

- 3.8. DUCT AND CONDUIT
 - 3.8.1. Clean out each section of duct or conduit by pulling a steel wire brush and mandrel of the correct size through the duct or conduit before pulling cables. Bush, ream and remove any sharp projections on all conduits prior to installation of Telecommunications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Telecommunications Engineer's Representative of the problems encountered.
 - 3.8.2. Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. Cable grip shall be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

END OF SECTION

27 05 53.00 Identification for Telecommunications Systems

1. General

1.1. WORK INCLUDED

1.1.1. Labelling

- .1 Confirm the cable designations with the Telecommunications Engineer's Representative prior to installation.
- .2 Adhere to CSA T528-93 (ANSI/TIA-606-latest version) colour codes.
- .3 Confirm labelling schemes with the Telecommunications Engineer's Representative prior to installation. The cable labelling scheme for all cables at both ends shall be as follows:

1.1.2. Horizontal Cable Labelling Schema

- .1 Provide labelling schema for Horizontal Voice/Data cables and IDC Blocks / Patch Panels shall be as follows:
- .2 TFF-NNNA Where
- .3 T indicates type of cable: Voice (V) or Data (D).
- .4 FF indicates the floor,
- .5 NNN indicates the Cable Number (numeric) 001... highest cable number, and
- .6 A indicates the telecom room designator for that floor.
- .7 Example: D7.017
- .8 D indicates data,
- .9 7 indicates 7th floor,
- .10 A indicates the cable is terminated in Telecom Room A, and
- .11 .017 indicates the 17th Cable.

1.1.3. Fibre Backbone Labelling Schema

- .1 The labelling for Fibre Backbone cabling shall be as follows:
 - .1 Example:
 - .2 XXX Strand To/From Address - YYth Floor, Room ZZZ
 - .3 Where:
 - .4 XXX = Pair count of cable(s)
 - .5 YY = Floor Number
 - .6 ZZZ = Room Number or Designation
 - .7 Note: Each strand shall be identified individually at the Fibre Connector.

2. Products

2.1. CABLE LABELS

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

- 2.1.2. Provide self-laminating vinyl cable labels with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area shall be of sufficient length to wrap around the cable at least one and one-half times.
- 2.1.3. Approved Manufacturers:
 - .1 Panduit: Part# LS8E,
 - .2 Easy-mark labeling software: Part# PROG-EMCD, or
 - .3 Equivalent.
- 2.2. LAMACOID LABELS
- 2.2.1. Provide black lamacoid plates with white 60 point Arial Narrow, engraved upper case letters enclosed by a white border on black background for racks, cabinets, and enclosures.
- 3. Execution
- 3.1. INSTALLATION
- 3.1.1. All active and passive equipment shall be labeled.
- 3.2. LABELLING
- 3.2.1. All labels must be mechanically printed using a laser printer. Hand-written labels are not permitted.
- 3.2.2. Provide 25% spare labels in each telecommunications room.
- 3.3. LABEL LOCATIONS
- 3.3.1. Cable identification labels shall appear at the following locations with the numbers indicated on the cable schedule and Drawings:
 - .1 102 mm 4" (in) from each end of the cable after termination,
 - .2 Front of Patch Panels,
 - .3 Front of IDC termination blocks,
 - .4 Front of workstation/Telecommunications outlet faceplates, and
 - .5 Each end of each Telecommunications Conduit.
- 3.3.2. Fibre Optic safety Labels shall appear at the following locations:
 - .1 Along the length of the conduit or inner duct at 3m 10' (ft.) intervals,
 - .2 At all junction boxes,
 - .3 At all pull boxes, and
 - .4 On all Fibre Optic Patch Panels.
- 3.3.3. Labels must be visible during installation and normal maintenance of the infrastructure.
- 3.3.4. Affix lamacoid labels to the front and rear of equipment in racks, cabinets.

END OF SECTION

27 08 00.00 Commissioning for Telecommunications Sections

1. General

1.1. WORK INCLUDED

1.1.1. General Testing Requirements

- .1 Test 100% of the installed cabling links. All cables must pass the requirements of the Standards as defined within this document. Any failing link must be diagnosed and corrected. Re-test to prove that the corrected link meets the performance requirements. Provide the final and passing result of the tests for all links in the test results documentation.
- .2 Correct all deficiencies before the Telecommunications Engineer's Representative will provide a certificate to release the Holdback on the project.
- .3 Submit a soft copy of test results in PDF and another ODBC compatible database format.
- .4 Test Patch Cords for 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.
- .5 Submit a test plan to the Telecommunications Engineer's Representative for approval prior to testing.
- .6 Submit a test report based on the cable schedules. Indicate for each cable, 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. An authorised person shall sign the test report at the completion of the project.

1.1.2. Copper Cabling Test Requirements

- .1 Test every cabling link in the installation (as required by the Cabling specified) in accordance with the Telecommunications Industry Association (TIA) Standard ANSI/TIA-1152, latest edition.
- .2 Test installed twisted-pair horizontal links from the Telecommunications Room to the workstation against the "Permanent Link" performance limits Specification as defined in ANSI/TIA-568.2, latest edition.
- .3 Only trained technicians who have successfully attended an appropriate training program and have been certified must execute the tests. Appropriate training programs include installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals) and Vendor supplied certifications for their product.
- .4 Test equipment shall comply with or exceed the accuracy requirements for enhanced level II and/or level III and/or level IIIe field testers (according to Cabling specified) as defined in ANSI/TIA-1152, latest edition. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in ANSI/TIA-1152, latest edition.
- .5 The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. Provide proof that the interface has been calibrated within the period recommended by the Manufacturer. Ensure that

normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

- .6 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.
- .7 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. Submit all Pass* categorized cable test results to the Owners' Engineering Representative for review and approval. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568, latest edition;).

1.1.3. Copper Cabling Performance Test Parameters

- .1 The test parameters for Category 6a are defined in TIA Category 6a Standard, which refers to TIA-568.2, latest edition. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 500 MHz) must meet or exceed the limit value determined in the above-mentioned Standard.
- .2 Testing of all 4 pairs of the horizontal cable (as specified in this document) shall 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 Return Loss,
 - .5 NEXT/FEXT,
 - .6 ACR,
 - .7 ELFEXT, PSELFEXT,
 - .8 Propagation Delay, Delay skew, and
 - .9 PSNEXT, PSACR.
- .3 Permanent link testing of all horizontal and backbone cables shall be completed in accordance with the follow test criteria:
 - .1 Wire Map including; end to end continuity, open and shorts, pair polarity,
 - .2 Cable length, and
 - .3 Basic Link.
- .4 The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. The portable tester shall be within the calibration period recommended by the manufacturer in order to achieve the manufacturer-specified measurement accuracy. Refer to manufacturer's test procedure.

1.1.4. Optical Fibre Cabling Test Requirements

- .1 Every Optical Fibre Cabling link in the installation shall be tested in accordance with the field test Specifications defined by the Telecommunications Industry Association (TIA) Standard ANSI/TIA-568.3, latest edition (or by the appropriate network application Standard(s) whichever is more demanding).
- .2 ANSI/TIA-568.0, latest edition, defines the passive cabling network to include cable, connectors, and splices (if present), between two optical fibre patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications

outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect, or (3) intermediate cross-connect to horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

- .3 Only trained technicians who have successfully attended an appropriate training program and have been certified must execute the tests. These certificates may have been issued by any of the following organisations or an equivalent organisation:
 - .1 The manufacturer of the Optical Fibre Cable and/or the Optical Fibre Connectors,
 - .2 The manufacturer of the test equipment used for the field certification,
 - .3 Training organisations authorised by BICSI (Building Industry Consulting Services International) or by the ACP (Association of Cabling Professionals™), or
 - .4 Vendor supplied certifications for their product.
- .4 Field test instruments for Multimode Fibre cabling shall meet the requirements of ANSI/TIA-526-14, latest edition. The light source shall meet the launch requirements of ANSI/TIA-455-50, latest edition; Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA-568.1, latest edition) with a Category 1 light source. Field test instruments for Single mode Fibre cabling shall meet the requirements of ANSI/TIA-526-7, latest edition.
- .5 The Optical Fibre launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.
- .6 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests as detailed below.
- .7 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

1.1.5. Optical Fibre Cabling Performance Test Parameters

- .1 ANSI/TIA Standard 568.3, latest edition prescribes that the single performance parameter for field testing of optical fibre links is link attenuation when installing components compliant with this Standard.
- .2 Calculate the link attenuation by the following formulas specified in ANSI/TIA/EIA 568, latest edition.
- .3 Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
- .4 The above link attenuation test limits are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14, latest edition, Method B and ANSI/TIA/EIA-526-7, latest edition, Method A.1. The user shall follow the procedures established by these Standards or application notes to accurately conduct performance testing.
- .5 The Horizontal Link (multimode): acceptable link attenuation for a multimode Horizontal Optical Fibre Cabling Solution is based on the maximum 90 m (295 ft.) distance. The Horizontal Optical Fibre Cabling link segments need to be tested at only one (1) wavelength. Because of the short length of cabling [90 m (295 ft.) or less], attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850

nm or 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14, latest edition, Method B, and One Reference Jumper. The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. this value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fibre cable.

- .6 Test the Backbone Link (multimode) in one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.
- .7 Test multimode Backbone Links at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14, latest edition. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.
- .8 Notes:
 - .1 Link attenuation has been based upon the use of a light source categorised by a Coupled Power Ratio (CPR) of Category 2, Under filled, per Annex B of ANSI/EIA/TIA-526-14, latest edition. The use of a light source categorised as Category 1, Overfilled, may provide results higher than the 2.0 dB limit. A field test tool based on LED (light emitting diode) light sources is a Category 1 device and typically yields high attenuation results.
 - .2 Links destined to be used with network applications that use laser light sources (under filled launch conditions) shall be tested with test equipment based on laser light sources. this rule should be followed for Cabling Solutions to support Gigabit Ethernet. Gigabit Ethernet only specifies laser light sources.
 - .3 For Gigabit Ethernet compliant certification (IEEE STD 802.3z application), use test equipment which uses a VCSEL (Vertical cavity surface emitting laser) at 850 nm (compliant with 1000BASE-SX) and a FP laser at 1310 nm (compliant with 1000BASE-LX).
- .9 Each optical fibre link terminated with an optical adapter system which does not impose a transmission direction because the adapters are not or cannot be ganged should be tested and documented in both directions since the direction of the signal transmission cannot be predicted at the time of installation.
- .10 Test each strand of fibre with an Optical Time Domain Reflectometer for length and attenuation. Performance test must be below the total return loss budget for the cable connectors/balun. Provide comprehensive optical time domain reflectometry (OTDR) testing for all fibre runs. Include a hard copy chart recording with the test documentation.

1.1.6. Cable Test Result Documentation

- .1 Record the test result information for each link in the memory of the field tester upon completion of the test.
- .2 The tester must transfer saved test result records into a Windows™-based database utility that allows for the maintenance, review and archiving of these test records. Provide a guarantee that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time.
- .3 Provide a PDF copy of the test results that lists all the links that have been tested with the following summary information:
 - .1 The identification of the link in accordance with the naming convention defined in the overall system documentation,

- .2 The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst case margin (margin is defined as the difference between the measured value and the test limit value),
- .3 The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number, and
- .4 The date and time the test results were saved in the memory of the tester.
- .4 Provide general information in the electronic data base containing the test result information for each link:
 - .1 The identification of the Owner site as specified by the end-user,
 - .2 The overall Pass/Fail evaluation of the link-under-test,
 - .3 The name of the Standard selected to execute the stored test results,
 - .4 The cable type and the value of the 'index of refraction' used for length calculations,
 - .5 The date and time the test results were saved in the memory of the tester,
 - .6 The brand name, model and serial number of the tester, and
 - .7 The revision of the tester software and the revision of the test Standards database in the tester.
- .5 Provide detailed test results data in the electronic database and PDF for each tested Copper Cable including:
 - .1 The identification of the link in accordance with the naming convention defined in the overall system documentation,
 - .2 The cable type and the value of NVP used for length calculations,
 - .3 The identification of the tester interface, and
 - .4 The test results information must contain information on each of the required test parameters that are listed in this document.

2. Products

2.1. APPROVED MANUFACTURERS

2.1.1. Copper Testers

- .1 Fluke DSX-5000.

2.1.2. Fibre Testers

- .1 EXFO,
- .2 Fluke OptiFiber® Pro OTDR, or
- .3 Fotec.

2.2. OPTICAL FIBRE TESTING

2.2.1. Provide 850nm and 1300nm $\pm$ 20nm wavelength LED light sources.

2.2.2. Spectral width of sources shall be $\pm$ 50nm for 850nm wavelengths and $\pm$ 140nm for 1300nm wavelengths.

2.2.3. Provide 1300nm and 1500nm $\pm$ 20nm wavelength Laser light sources.

2.2.4. Output stability $\pm$ 0.40 dB from 0 to 50oC. Long term stability shall be $\pm$ 0.10 dB at 25oC.

2.3. WARRANTY AND CERTIFICATION

2.3.1. Provide to Owner, one system certification at the end of the project.

3. Execution

3.1. WARRANTY AND CERTIFICATION REQUIREMENTS

3.1.1. Submit the Structured Cabling Solution certification and the user manual.

3.1.2. Provide letter(s) of Certification within two weeks of the date of substantial performance of the contract of the project to the Telecommunications Engineer's Representative. This document will include the following:

- .1 Verification of the performance of the installed system,
- .2 Identification of the installation by location and project number, and
- .3 A copy of the Warranty.

3.1.3. Within 7 days of the award of contract, submit copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the project. Provide a copy of the form with Specification submission.

END OF SECTION

27 11 16.00 Telecommunications Cabinets, Racks, Frames and Enclosures

1. General

1.1. WORK INCLUDED

1.1.1. Equipment Locations

- .1 Devices, Racks, Cabinets, Brackets and Backboards 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.

1.1.2. Telecommunication Racks and Cabinets

- .1 Provide all wall mount brackets, racks, cabinets and components as indicated in this document and on the Contract drawings.
- .2 Provide all racks, cabinets, wall mount brackets and components from the same manufacturer and identical style shall be used throughout the project, unless specifically noted in this section.
- .3 All racks, cabinets, wall mount brackets and components shall meet or exceed requirements as defined by ANSI/EIA-310-E, Cabinets, Racks, Panels and Associated Equipment.
- .4 All racks, cabinets, wall mount brackets and components required for this project will be reflected on Telecommunications Room Layout & Rack Elevation Detail drawings (If required).
- .5 At a minimum, provide one (1) new 2U horizontal cable management panel for each new patch panel installed, when no rack elevation drawing is provided. Quantities shown on rack elevation drawing(s) shall supersede this requirement.
- .6 In all cases wall mount brackets, racks, cabinets and components shall be powder-coated black.
- .7 Approved Manufacturers:
 - .1 Belden Incorporated,

1.1.3. Cabling

- .1 Reference General requirements and the Execution requirements as applicable under Sections 27 13 13.00 TELECOMMUNICATIONS COPPER BACKBONE CABLING, 27 13 23.00 TELECOMMUNICATIONS OPTICAL FIBRE BACKBONE CABLING.

2. Products

2.1. FLOOR MOUNT TELECOMMUNICATIONS RACKS

- 2.1.1. Free standing, 482 mm (19") rack, welded frame constructed of minimum 11 GA (0.120") steel with anchor holes in base.
- 2.1.2. Racks shall have a minimum of 45U standard EIA vertical rack positions with permanently marked U-spacing identification.
- 2.1.3. Mounting holes as per EIA-310-E, size 10-32 tapped double sided.
- 2.1.4. Secured all equipment racks to the floor with properly sized hardware. Install rack on top of the finished floor in all Telecommunications Spaces.
- 2.1.5. Racks shall be complete with one (1) dual bolt ground lug mounting position.

- 2.1.6. Utilize proper fasteners for the vertical cable managers, power bars and all accessories as per the manufacturer's recommendations.

2.2. TELECOMMUNICATIONS RACK & CABINET COMPONENTS

2.2.1. Vertical Cable Managers

- .1 Constructed of minimum 16 GA (0.060") steel with stiffeners riveted/welded inside for additional strength.
- .2 Management panels shall have a hinged door with nonmagnetic closing mechanism. A fully shielded magnetic closing mechanism shall also be accepted.
- .3 Openings for cable routing shall have grommets to ensure smooth transition of the cables.
- .4 Management panels shall have lancets along the back of the cable manager to allow for the fastening of the cable(s) to the outside of the manager itself.

2.2.2. Horizontal Cable Management Panel

- .1 Welded construction, fabricated of a minimum of 16 GA (0.060") steel & shall be a minimum of 2U and 76mm (3")D.
- .2 Panel shall have hinged cover with nonmagnetic closing mechanism. A fully shielded magnetic closing mechanism shall also be accepted.
- .3 Openings for cable routing shall have grommets to ensure smooth transition of the cables.

2.2.3. Shielded Cord Vertical Power Bar

- .1 Fabricated from 18 GA (0.048") steel & mountable into 19" EIA cabinet frames or network racks.
- .2 Each power bar shall have a NEMA L5-30 input plug that comes with a minimum of 3m 10'(ft) cord and the following output receptacles:
 - .1 12 NEMA 5-20
- .3 Shielded Cord features a 300V capacity, 100% coverage aluminum foil - polyester tape shield, 7x28 AWG tinned copper drain wire (20 AWG), and a durable PVC outer coating.
- .4 The power bar(s) shall be UL/ULC listed and must meet UL/ULC 1363 and 1449 requirements.
- .5 Features breaker protection with reset button, three-stage surge protection, fused and non-switched with illuminated power switch showing power "ON".

3. Execution

3.1. TELECOMMUNICATIONS WALL MOUNT BRACKETS, RACKS, CABINETS AND COMPONENTS

- 3.1.1. Properly secure the racks on top of the finished floor and wall. Ground all racks and cabinets in accordance with the parameters within this specification document.
- 3.1.2. Refer to detail drawings for location(s) of Telecommunications wall mount brackets, racks and cabinets.
- 3.1.3. Provide all Telecommunications rack and cabinet components as per the detail drawings. Provide (including levelling and ganging) all racks, cabinets and their components for a complete functioning system.

- 3.1.4. Secure all wall mounted equipment (i.e. rotating rack & wall mount cabinet) backboards.
- 3.2. TELECOMMUNICATIONS RACK & CABINET COMPONENTS
 - 3.2.1. Vertical Cable Managers
 - .1 Install two (2) vertical cable managers for each floor/wall mount rack, except where racks are ganged together.
 - .2 Where racks are ganged together, provide one (1) vertical cable manager between racks.
 - .3 For cabinets, provide minimum size of 215mm (8.5") W x 150mm (6") D vertical cable manager on each side of each cabinet. Two vertical Cable Managers shall be installed for each floor mount cabinet.
 - 3.2.2. Horizontal Cable Management Panel
 - .1 Install one horizontal cable manager per rack plus an additional one for every patch panel and every network switch when no rack elevation is provided, otherwise quantities on rack elevation drawing supersede this requirement. Assume 48 port switches, one port for every horizontal cable installed.
 - 3.2.3. Shielded Cord Vertical Power Bar
 - .1 Unless noted elsewhere on an elevated drawing, provide a minimum of one power bar to each rack/cabinet and mount on the rear right side of the rack with cord end located at the top of the rack/cabinet.

END OF SECTION

27 11 19.00 Telecommunications Termination Blocks and Patch Panels

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. COPPER PATCH PANELS

1.2.1. The Patch Panel shall support the appropriate applications, and facilitate cross connection and inter-connection using Modular Patch Cords.

1.3. OPTICAL FIBRE ENCLOSURE

1.3.1. The Patch Panel shall support the appropriate applications, and facilitate cross connection and inter-connection using Modular Patch Cords.

2. Products

2.1. COPPER PATCH PANELS

2.1.1. 482 mm (19") rack mountable MDVO or High Density style 1U 24-port or 2U 48 Port Patch Panel. Refer to Rack Elevation Detail(s) for correct style.

2.1.2. Minimum 50 microns of hard gold over nickel or copper on outlet contact wires.

2.1.3. Patch Panels shall be suitable for rack mounting and shall incorporate integral labeling spaces for port identification. Provide blank labeling strips.

2.1.4. Colour: Black

2.2. OPTICAL FIBRE ENCLOSURE

2.2.1. The Optical Fibre Patch Panel Tray shall be compatible with standard 19" Racks, must be serviceable from the front by allowing the Fibre Patch Panel to slide or pivot away from the Rack. Mount the panel as indicated on Detail Drawings.

2.2.2. Performance shall meet all requirements of ANSI/TIA-568.3 Section 5 – Connecting Hardware.

2.2.3. The Fibre Optic Patch Panel(s) shall:

- .1 Be sized to accommodate the termination of all Fibre strands at each cable termination point,
- .2 Be capable of terminating tight buffered and loose tube cable and accept all popular connector types, and
- .3 Have a slide out shelf or swing out drawer for access to the Fibres.

2.2.4. An appropriately sized splice tray shall be included as required.

2.2.5. The Fibre Optic Patch Panel shall provide for bend radius control and strain relief to accommodate the Fibre Optic Cables.

2.3. OPTICAL FIBRE ADAPTER STRIPS AND CONNECTORS

2.3.1. The Optical Fibre Adapter Strips shall:

- .1 Be colour coded to identify performance grade:
 - .1 OM3 / OM4 – Aqua,
 - .2 OS2 – Blue, and
 - .3 OS2 APC – Green;
- .2 Have either phosphor bronze or zirconia ceramic sleeves,
- .3 Accommodate either multimode or single mode optical fibre,
- .4 Be pre-loaded with 6 adapters (single density),
- .5 Be compatible with LC connectors,
- .6 Have an insertion loss of 0.2dB for multimode sleeves and 0.15 dB for single mode sleeves,
- .7 Have a durability of 1000 matings, and
- .8 Have a tensile strength of 50-lbs. (220 N), <0.2 dB change.

3. Execution

3.1. PATCH PANELS

- 3.1.1. Provide Patch Panels in each rack location in sufficient quantities to terminate all horizontal cables specified with no less than 6 spare ports per Patch Panel to be left vacant for future use.

3.2. OPTICAL FIBRE ENCLOSURE

- 3.2.1. Provide all necessary accessories for a complete Fibre enclosure for all strands of Fibre, including but not limited to; clear cover plates, mounting brackets and hardware, duplex fibre bulkheads (adapter sleeves-plates/couplers), fibre connectors and fibre cable management. The Telecommunications Contractor is responsible for supplying blank mounting plates for all unused openings.

END OF SECTION

27 13 23.00 Telecommunications Optical Fibre Backbone Cabling

1. General

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. Use pathways installed by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers.
- 1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.
- 1.1.3. Install backbone cables in accordance with manufacturer's specifications ensuring that proper installation techniques are used and that the cable's maximum pull-force and maximum bend radii specifications are adhered to.
- 1.1.4. Backbone cable/cable bundles shall be secured properly when fastened to backboards or termination cabinets/racks.
- 1.1.5. Fibre optic cables shall be completely protected with corrugated inner duct for the entire length of the cable run. Refer to section 27 05 28.00 for situations where inner duct is not required.
- 1.1.6. Verify all backbone cable run lengths on site prior to ordering.
- 1.1.7. Fibre Backbone cabling requirements for this project will be reflected on Telecommunications backbone riser diagram(s).

1.2. CABLE ROUTING

- 1.2.1. 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 Telecommunications Engineer's Representative prior to installation.
- 1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Telecommunications Engineer's Representative and documented on as-built drawings.

1.3. BACKBONE LOCATIONS

- 1.3.1. Backbone cabling locations may be relocated, prior to installation, from the location shown on the Drawings, to a maximum distance of 3.05m (10'-0") without adjustment to the Contract price.

1.4. FIBRE OPTIC CABLES

- 1.4.1. All fibre optic cables shall meet or exceed the latest requirements of TIA-568.3, latest version.
- 1.4.2. The cables shall have:
 - .1 Sequential length markings printed on the cable jacket,
 - .2 A Crush Resistance of 2000 N/cm as per TIA-455-41, latest edition,
 - .3 An Impact Resistance of 1000 impacts with 1.6 N-m as per TIA-455-25, latest edition, and
 - .4 A minimum Flexure rating of 2000 cycles as per TIA-455-104, latest edition.

1.5. DISTRIBUTION / BREAKOUT SERIES CABLE

- 1.5.1. Distribution / Breakout Series cable shall have 900-micron tight buffered fibre individually placed in a 2mm coded sub-unit with aramid strength members.
- 1.5.2. The cable shall have a minimum bending radius of 15x cable diameter and 10x cable diameter (long term no-load and short term load, respectively).
- 1.5.3. The cable shall be fully dielectric with no metallic elements in the cable.

1.6. CABLE RATINGS

- 1.6.1. The non-plenum/plenum cable shall be ETL or UL/ULC Listed and CSA Certified as type ONFR / ONFP, in accordance with the Binational Standard for Communications Cable, UL444/C22.2 No. 214-latest version.

1.7. CABLE CONNECTORS AND CLAMPS

- 1.7.1. All connectors and clamps must be listed and rated for outside use and properly sized to accept the wire and strand size involved.

2. Products

2.1. MULTIMODE (DISTRIBUTION SERIES) OPTICAL FIBRE CABLE

- 2.1.1. Cable to be formed into groups of 6 or 12 fibres each. Groups and individual fibres to be identified in accordance with current standards.
- 2.1.2. Groups assembled to form a single compact core and covered by a protective sheath.
- 2.1.3. Sheath consisting of an overall jacket and one or more layers of dielectric material applied over the core.
- 2.1.4. All tests to be performed at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
- 2.1.5. Fibre cables to be tight buffer distribution type design with an OFNP Plenum / OFNR Non-Plenum rated jacket as required by local codes. The cable shall be CSA certified and stamped accordingly.

2.2. SYSTEM PERFORMANCE

2.2.1. Multimode Fibre Optic Backbone System

- .1 All components of the Fibre Optic Backbone channel shall meet the minimum performance characteristics of: OM4 – 50/125um laser optimized with minimum bandwidth of 4700MHz/km at 850nm and 500MHz/km at 1300nm up to 550 meters.

2.3. CERTIFICATION

2.3.1. Acceptable manufacturers for the complete Structure Cabling Solution:

- .1 Manufacturer / Contractor Certification
- .2 Belden Incorporated / CSV – Certified Systems Vendor

2.4. VERTICAL CABLE SUPPORT

- 2.4.1. Closed mesh type, galvanized finish metal vertical cable support system
- 2.4.2. Double eye attachment system

-
- 2.4.3. Size support(s) to accommodate size & quantity of vertical cabling.
- 2.4.4. Approved Products:
- .1 Pass & Seymour Flexcor Wire Mesh Grip system, and
 - .2 Kellem Closed Mesh Support Grip system.
- 2.5. CABLE LUBRICANT
- 2.5.1. The use of pulling lubricants of any kind is strictly prohibited.
3. Execution
- 3.1. INSTALLATION
- 3.1.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Replace damaged cables without any additional compensation.
- 3.2. BACKBONE CABLE DISTRIBUTION
- 3.2.1. Provide appropriately sized fibre optic cable(s) as depicted on the Telecommunications Riser Diagram(s). Refer to backboard and rack elevation Drawings for mounting type & locations. Coordinate mounting location with Owner prior to termination for terminations made in an existing Telecommunications Room.
- 3.2.2. Provide appropriate & size of optical fibre cable(s) as depicted on the Telecommunications Riser Diagram(s). At each cable end, terminate cable in a new fibre patch panel. See rack elevations for details. Coordinate mounting location with Owner prior to termination for terminations to be made in an existing Telecommunications room.
- 3.2.3. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.2.4. Install and terminate all cables and components in accordance with applicable Codes, Standards and Regulations.
- 3.2.5. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available cable supports shall be used in the ceiling space to coil slack.
- 3.2.6. Neatly bundle all cables using Velcro straps. Separate Voice, Data and Fibre cables into separate distinct bundles for identification purposes.
- 3.2.7. Pull all cables in a continuous run. Do not splice any cables for any reason, unless prior consent is given by the Engineer's Representative.
- 3.2.8. Provide vertical cable support system(s) for cabling where vertical route length exceeds maximum distance that cable is rated to be self-supporting. Install vertical cable support system(s) as per manufacturer's guidelines.
- 3.2.9. Ground all components to manufacturer's specifications and standard practices.
- 3.2.10. Terminate all strands of each cable at both ends, including all spares.
- 3.2.11. Test, label and document as specified in this document.

3.3. OVERHEAD BACKBONE CABLE INSTALLATION

- 3.3.1. Install all cables identified as Overhead via the indoor and outdoor pathways as provided by the Electrical contractor. The Electrical Contractor will install all indoor conduit and outdoor overhead poles complete with a messenger wire.
- 3.3.2. Install cables so that they loosely lash around the messenger wire and/or are supported by suspension clamps over the entire length. Every cable shall be individually and loosely lashed to the messenger wire to allow for expansion and contraction of the cables and messenger. Under no circumstance shall one of the cables be used to support other cables.
- 3.3.3. Minimise excess stress on the Optical fibre cabling.
- 3.3.4. Installation of cables shall be with the use of a cable chute to pay out the cable as it is installed. Securely fasten the cable chute to the pole using a pole attachment and adapter.
- 3.3.5. Align the payout reel linearly with the pole and the direction of the cable travel. Locate the pay out reel a distance of twice the height of the messenger to avoid excess tension on the Cable as it is installed.
- 3.3.6. Use cable blocks or rollers at a distance of every 25 feet to support the cable or cables between poles.
- 3.3.7. Use a cable puller and adjustable pressure brake assembly as necessary to prevent slack from pulling back onto the strand line when tension is removed from the pull line.
- 3.3.8. Use spacers and bands to separate the cable from the messenger wire and hardware attached to the wire. The band shall be used to hold the cable and spacers next to the wire, it should not be drawn too tightly on the cable, and it should only support the cable.
- 3.3.9. Install one flat bottom expansion loop for every pole. Where distances between poles is greater than 200 feet, install two flat bottom expansion loops. Every cable installed should have a flat bottom expansion loop at every pole. Locate expansion loop directly at the pole. After the loop is formed, the cable is lashed to the spacer and the lashing wire shall be secured on one side. The lashing wire should be wrapped around the Wire three times and then tied off at the lashing wire clamp.
- 3.3.10. The Telecommunications Contractor will be required to make any necessary penetrations to building walls to pass the cables through the wall. Penetration size shall be minimised. Seal all penetrations with outdoor silicone to ensure no moisture or water ingress into the buildings. Silicone must be resistant to degradation from temperature cycles and UV exposure.
- 3.3.11. Use an approved cable guide and lashing device to secure the cable to the messenger strand.
- 3.3.12. Clamp cable to the exterior of the building with approved galvanized steel cable clamps.

3.4. CABLE BONDING

- 3.4.1. Refer to Section 27 05 26.00 GROUNDING AND BONDING FOR TELECOMMUNICATIONS SYSTEMS.

3.5. CABLE LUBRICANT

- 3.5.1. The use of pulling lubricants of any kind is strictly prohibited.

END OF SECTION

27 15 00.19 Data Telecommunications Horizontal Cabling

1. General

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. The Telecommunications Contractor shall use pathways by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers.
- 1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.
- 1.1.3. Ensure ANSI/TIA-568.2, latest edition installation practices are followed. Install horizontal cables in accordance with manufacturer's specifications ensuring that proper installation techniques are adhered to.
- 1.1.4. Terminate all pairs of cable at each cable end.
- 1.1.5. Inform the Telecommunications Engineer's Representative immediately of any horizontal cable runs exceeding 90 m 295'(ft). Minimum horizontal cable run (if required) shall not be less than that specified in manufacturer's specifications.
- 1.1.6. The Telecommunications Engineer's Representative shall determine the quality of workmanship during installation. Cables that have not been properly installed will be reinstalled by the Telecommunications Contractor at no additional expense to the contract.

1.2. CABLE ROUTING

- 1.2.1. 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 Telecommunications Engineer's Representative prior to installation.
- 1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Telecommunications Engineer's Representative and documented on as-built drawings.

2. Products

2.1. 4-PAIR HORIZONTAL COPPER CABLE

- 2.1.1. Four pair, twisted pair cable consisting of #22-26 AWG solid conductors, formed into four individually twisted pairs and enclosed in an appropriately rated thermoplastic jacket as required by local codes. All individual conductors to be insulated with fluorinated ethylene propylene (FEP).
- 2.1.2. All cabling must be CSA certified and stamped accordingly
- 2.1.3. Cable to withstand a bend radius of 25.4 mm (1") at a temperature of $-20^{\circ}\text{C} \pm 1^{\circ}\text{C}$ without jacket or insulation cracking.

- 2.1.4. All cables shall have an outer jacket colour as identified below:

Cable Designation	Colour
Data	Blue

2.2. SYSTEM PERFORMANCE

2.2.1. 4-Pair Horizontal Copper Cabling

- .1 All components of the horizontal data channel shall meet the minimum performance characteristics of:

Cable Designation	Performance
Data	Category 6a – 500MHz and a data rate of 10Gb/s, with an outside diameter no greater than 0.27".

2.3. CERTIFICATION

2.3.1. Acceptable manufacturers for the complete Structured Cabling Solution:

- .1 Manufacturer / Contractor Certification
.1 Belden Incorporated / CSV – Certified Systems Vendor

3. Execution

3.1. GENERAL CONDITIONS

- 3.1.1. Remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5 to 6a cables and 25 mm (1") for Category 3 cables. Any specific manufacturer's installation guidelines shall supersede the above.
- 3.1.2. Do not splice any cables for any reason, unless prior consent is given by the Engineer's Representative.

3.2. INSTALLATION

- 3.2.1. Avoid scraping, denting, painting, or otherwise damaging cables, before, during or after installation. Replace damaged cables without any additional compensation.
- 3.2.2. Ground all cables and components to manufacturer's specifications and standard practices.

3.3. HORIZONTAL CABLE DISTRIBUTION

- 3.3.1. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack. For completely enclosed zone conduit distribution systems, provide 3.05 m (10'-0") of slack at the Telecommunications room end only.
- 3.3.2. Follow proper installation and termination practices for UTP copper and Optical Fibre cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius. For Optical Fibre cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.

- 3.3.3. Bundle all horizontal cables on the Telecommunications Racks using Velcro straps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes where applicable.
- 3.3.4. Strap bundles in Telecommunications rooms, at a maximum of 203 mm 8"(in) separation. Bundles shall contain no more than fifty (50) cables to eliminate any excessive stress on the cable jackets.
- 3.3.5. When bundling 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.
- 3.3.6. All exposed cabling at the workstation between wall/floor-input point locations and systems furniture is to be wrapped with black split loom tubing, size and length as required to suit.
- 3.3.7. Route/install Telecommunications cabling in systems furniture, lab casework furniture & mill work as denoted on floor plans.
- 3.3.8. Provide Data cables to each outlet indicated on the drawings. The Telecommunications Contractor shall refer to the legends on the drawing to determine the number of cables to each outlet location.
- 3.4. TERMINATION REQUIREMENTS
 - 3.4.1. UTP Cables
 - .1 Terminate cabling using TIA 568A configuration, unless noted otherwise.
 - 3.4.2. Fibre
 - .1 Terminate all multimode Fibre Optic Cabling using fusion spliced connectors unless expressly written otherwise in this document. Use splicing techniques such as mechanical and heat shrink fusion splicing where specified.
 - 3.4.3. Terminate test and label each cable in accordance with the parameters stated in this specification document.

END OF SECTION

27 15 43.00 Telecommunications Faceplates and Connectors

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. OUTLET LOCATIONS

1.2.1. Horizontal Cable 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.

1.3. OUTLET COVER PLATES

1.3.1. When Electrical and Telecommunications receptacles are ganged together, cover plates shall be supplied and installed by the Electrical Contractor, unless otherwise noted. Where Telecommunications receptacles are stand alone or separate from Electrical receptacles, cover plates shall be supplied and installed by the Telecommunications Contractor.

2. Products

2.1. EIGHT-POSITION MODULAR CONNECTORS

2.1.1. The eight-position modular connectors must be matched appropriately with the cables to ensure that end to end Manufacturer Warranties will be applicable.

2.1.2. Eight-position modular style outlet with insulation displacement contacts for termination of all eight conductors.

2.1.3. Outlets shall be suitable for installation in faceplates at work station locations, surface raceway, or surface mount boxes.

2.1.4. All Data and Voice modules shall have the following minimum performance parameters:

- .1 Modular Jack Current rating: 1.5 amperes maximum
- .2 Modular Jack Durability: 1,000 mating cycles
- .3 Modular Jack Contact Pressure: 100 grams, minimum per contact
- .4 Dielectric Voltage Strength: 1,000 V RMS at 60 Hz for 1 minute
- .5 Insulation Resistance: 200 MΩ minimum
- .6 Contact Resistance: 1 M Ω per contact

2.1.5. All Horizontal 4-pair cables shall be terminated with the jack colours as described below. Where the specified Copper Patch Panels are modular, the same jack colours shall be used at both ends of each cable:

Function	Colour	Quantity
Data	Blue	As per Drawing

2.1.6. Outlets shall be suitable for installation in faceplates at workstation locations, surface raceway, or surface mount boxes.

2.2. OPTICAL FIBRE ADAPTER STRIPS AND CONNECTORS

2.2.1. The Optical Fire Adapter Strips shall:

- .1 Have either phosphor bronze or zirconia ceramic sleeves.
- .2 Accommodate either multimode or single mode optical fibre.
- .3 Be pre-loaded with 6 adapters (single density).
- .4 Be compatible with FC, LC, MT-RJ, SC, SC Duplex, or ST connectors.
- .5 Have an insertion loss of 0.2db for multimode sleeves and 0.15 db for single mode sleeves.
- .6 Have a durability of 1000 matings.
- .7 Have a tensile strength of 50-lbs. (220 n), <0.2 db change.

2.2.2. Multimode Optical Fibre

- .1 The Multimode Optical Fibre Patch Cord Connector shall be field installable, multimode PC polish-type with ceramic ferrule with a typical insertion loss of 0.3 dB (guaranteed 0.5 dB) and a reflectance of -20 dB.
- .2 All field installable Multimode Fibre Optic Connectors for this project shall be LC.

2.3. WORKSTATION OUTLETS

2.3.1. Modular Furniture Faceplate

2.3.2. Use 3 or 4-port modular furniture faceplate adapters for furniture outlets that have modular furniture knockouts. Equip each outlet with the appropriate UTP modules as indicated in this section.

2.3.3. Use recessed blanks for all unused ports. Blanks must match the frame colour.

2.3.4. Verify furniture manufacturer prior to ordering.

2.3.5. Provide a ½" spacer/adaptor, if required, to ensure faceplate can be properly installed on systems furniture maintaining proper bend radius

2.4. DECORA ADAPTERS

2.4.1. UTP Cables

- .1 Where Telecommunications wall boxes are ganged with electrical outlet boxes, floor or raceway outlets shall utilise 3 or 4-port Decora style adapters/inserts. Equip each outlet with the appropriate UTP modules as indicated in this section.
- .2 Provide all Telecommunications workstation adapters/inserts for all Telecommunications outlets (ganged or single) when decora style faceplates are utilized. Provide decora style faceplates for all Telecommunications wall box locations where not ganged with Electrical.

2.5. BLANK INSERTS

2.5.1. Install Blank Inserts in unused Telecommunications ports. Blank inserts shall match faceplates.

2.6. SURFACE MOUNT BOXES

2.6.1. All systems furniture raceways that do not have a modular furniture knockout shall utilise 2- or 4-port surface mount boxes. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

3. Execution

3.1. GENERAL CONDITIONS

3.1.1. When terminating Copper Cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5e / 6 / 6A cables and 25 mm (1") for Category 3 cables.

3.1.2. At the workstation end, terminate each 4-pair Horizontal Cable on an appropriately colored 8-position module, located in the specified style faceplate. At the Telecommunications Room end, terminate cables within their respective termination fields. Refer to Detail Drawings for further details.

3.2. WORKSTATION OUTLET ORIENTATION

3.2.1. Verify the position of jacks with the Telecommunications Engineer's Representative prior to installation.

3.2.2. Modular Furniture Faceplate

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

Data 1	Top		Data 1	Left
Data 2	Middle	or	Data 2	Middle
Voice	Bottom		Voice	Right

3.2.3. Decora Adapters

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

Data 1	Top		Data 1	Left
Data 2	Middle	or	Data 2	Middle
Voice	Bottom		Voice	Right

3.2.4. Surface Boxes

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

Data 1	Top Left		Data 1	Bottom Left
Data 2	Top Right	or	Data 2	Top Left
Voice 1	Bottom Left		Voice 1	Bottom Right
Voice 2	Bottom Right		Voice 2	Top Right

3.3. COVER PLATES AND DECORA STYLE BLANKS

3.3.1. Provide cover plates and decora style blanks to all unused Telecommunications rough-ins.

3.4. BLANK INSERTS

3.4.1. All unused Telecommunications ports must be installed with blank inserts. For copper patch panels, use Black. For workstation outlets match existing/electrical.

END OF SECTION

27 16 19.00 Telecommunications Patch Cords and Cross Connect Wire

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. OPTICAL FIBRE PATCH CORDS

1.2.1. The type of fibre Patch Cords be consistent with type of fibre backbone.

1.2.2. Multimode Optical Fibre

- .1 Multimode Optical Fibre Patch Cords shall be made of 50/125- or 62.5/125-micron fibre with a maximum attenuation of 3.5 dB/km @ 850 nm and 1.25 dB/km @ 1300 nm. Type of fibre Patch Cords shall be consistent with type of fibre backbone.
- .2 The Multimode Optical Fibre Patch Cord connector shall be multimode PC polish-type with ceramic ferrule with a typical insertion loss of 0.3 dB (guaranteed 0.5 dB) and a reflectance of –20 dB.

1.2.3. The Optical Fibre Cord assembly shall be LC construction.

1.3. COPPER PATCH CORDS

1.3.1. Connect UTP Patch Cords in the Telecom Room to the active equipment using 8 position 4 pair T568A/B:T568A/B Patch Cords.

1.3.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the diameter, grade, and manufacturer of the Telecommunications cable that is being Warranted.

2. Products

2.1. OPTICAL FIBRE PATCH CORDS AND PIGTAIL ASSEMBLIES

2.1.1. Optical fibre Backbone cable strands shall be connected to the active equipment using Fibre Patch Cords. The Fibre Patch Cords shall be OFNR rated and stamped accordingly. Fibre Patch Cords shall be consistent with the grade and manufacturer of the Fibre cable that is being warranted.

2.1.2. Provide Fibre Patch Cords for complete connectivity of Fibre Cables. The Owner reserves the right to switch the Fibre Patch Cords to a different configuration at no extra cost, 10 business days prior to delivery.

2.1.3. Duplex Fibre Zip Cords quantities and lengths are as follows:

Type	Length	End 1	End 2	Qty
MM	7'	LC	LC	As per Drawing

2.2. UTP PATCH CORDS AND PIGTAIL ASSEMBLIES

2.2.1. All Data Patch Cords shall be connected in the Telecom Room to the Owner supplied active equipment using 8 position 4 pair patch cords.

- 2.2.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the diameter grade and manufacturer of the Telecommunications cable that is being warranted.
- 2.2.3. Patch cords shall have stranded copper conductors (where system dictates) and designed to provide a mated-connection performance that exceeds the requirements per ANSI/TIA-568-D.
- 2.2.4. Patch cords and pigtail assemblies to be factory assembled and not site prepared, complete with snag less boot.
- 2.2.5. Patch Cord / Pigtail requirements:

Designation	Termination	Colour	Length	Location
Data	RJ45/RJ45	White	10' (ft) 3m	Telecom. Room
Data	RJ45/RJ45	White	10' (ft) 3m	Workstation

3. Execution

3.1. INSTALLATION

- 3.1.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Telecommunications Contractor without any additional compensation shall replace damaged cables.

3.2. OPTICAL FIBRE PATCH CORDS

- 3.2.1. Assume all strands of optical fibre cable(s) shall be patched.

3.3. UTP COPPER PATCH CORDS

- 3.3.1. At Telecommunications Room end, provide one (1) patch cord for each data cable installed. Communications Contractor shall be responsible for patching all data cabling. A patching schedule shall be provided to the Communications Contractor prior to installation. Patch Cords provided must maintain the Channel Solution.
- 3.3.2. At workstation end, provide one (1) patch cord for each data cable installed. Patch Cords supplied and installed must maintain the Channel Solution.

END OF SECTION