



Smith + Andersen

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COMMUNICATIONS SPECIFICATION

PROJECT NAME:

ARC LIBRARY AND IITS RENO

1265 MILITARY TRAIL

TORONTO, ON

OUR PROJECT NUMBER:

03118.008.D.001

DATE:

2021-10-20

ISSUED FOR:

CONSTRUCTION

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END OF SECTION

27 00 05.10 General Instructions for Communications Sections

1. General

1.1. OVERVIEW

- 1.1.1. Read and comply with all sections of this document.
- 1.1.2. Read and complete the Communications Tender forms.
- 1.1.3. All Drawings and general provisions of the Contract, including all General Conditions, Division 1 Specification Sections (if present) and Instructions to Bidders apply to this section and all other Specification sections.
- 1.1.4. Provide all labour, materials, tools, and equipment required for the complete installation of Work called for in all sections of the Contract Documents.

1.2. WORK INCLUDED

- 1.2.1. The Communications Contractor will be responsible for providing a new Telecommunications Structured Cabling systems for the area included in the scope of this Project. The Structured Cabling Systems shall be as follows:
 - .1 Horizontal Structured Cabling System consisting of 4-pair Copper Cabling for telephony and data applications.
- 1.2.2. All horizontal cabling will be serviced from the nearest logical Telecommunications Room, either existing or new as shown on floor plans.
- 1.2.3. The Telecommunications Structured Cabling system shall be 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.
- 1.2.4. All exposed components of the Telecommunications Cabling System that is to be located within mechanical spaces deemed to be a Return Air Plenum must have a CMP (FT6) rating. CMR (FT4) rated components may be used in mechanical spaces pending approval by all Authorities Having Jurisdiction (AHJ) and/or the Communications 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
- 1.2.5. 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 Communications Contractor to verify all part numbers and to report any errors and/or omissions in this Specification with their bid submissions.
- 1.2.6. Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurements.
- 1.2.7. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- 1.2.8. Include in bid 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.

1.3. CONTRACT DOCUMENTS

1.3.1. The Communications Contractor must read and comply with all requirements as stated in Divisions 0 and 1. In the event of a conflict between Divisions 0 or Division 1 sections and information contained in sections 27 00 05.30 - General Instructions, 27 00 05.60 – Administrative Requirements, and 27 00 05.70 – Project Specific Requirements of this document, Divisions 0 and 1 shall have precedence.

1.4. BIDDER INQUIRIES

1.4.1. 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:

Joshua Blizzard
Smith + Andersen
1100 - 100 Sheppard Avenue East, Toronto, ON - M2N 6N5
Telephone: 416 487-8151 ext. 1285
Facsimile: 416 487-9104
E-mail: joshua.blizzard@smithandandersen.com

1.4.2. 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.

1.5. TENDER FORMS AND SUBMISSION OF TENDERS

1.5.1. Submit with Tender all information called for on the Communications Tender and Supplementary Tender Forms. Tenders not completed in full may, at the discretion of the Client, be rejected.

1.5.2. Show separate, identified, alternate and unit prices for optional components or items called for as additions to or deductions from the Tender amount.

1.5.3. The Client reserves the right to accept or reject any substitution without question.

1.5.4. All prices shall 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. Successful installation of the Structured Cabling Solution is one that meets the requirements of this document and meets all telecommunications (and related) standards, municipal, local, Provincial and Federal building, safety, fire and electrical codes.

1.6. HOLDBACK

1.6.1. The value for testing and documentation (cable test results and as-built), 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 Communications Contractor until testing and correction of deficiencies is 100% complete.

1.7. SCHEDULE

1.7.1. By submitting a response to this document and associated Drawings, the Communications Contractor agrees to meet and adhere to all project milestones as indicated in the project schedule(s).

1.7.2. The Communications Contractor acknowledges that project schedule(s) are subject to change. The Communications Contractor shall verify with the Communications Engineer's Representative and/or General Contractor all project milestones.

1.8. LABOUR

- 1.8.1. The Communications Contractor must comply with all job-site requirements for the duration of the project.
- 1.8.2. The Communications Contractor shall not assign or sub-contract any Work without the prior written consent of the Communications Engineer's Representative. In the event of sub-contractor approval, a complete list of sub-contractors shall be submitted with the Tender response.
- 1.8.3. The Communications Contractor agrees to use only tradesmen who are fully trained, qualified and experienced on the installation, termination and testing of the Structured Cabling Solution.
- 1.8.4. 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 Communications Contractor shall obtain the consent of the Communications Engineer's Representative prior to submitting a bid response.
- 1.8.5. The Communications Contractor shall make any changes or alterations required by an authorized inspector of the authority having jurisdiction.
- 1.8.6. The Communications Contractor shall receive consent from the Communications Engineer's Representative before changing the Project Manager and/or Site Supervisor during the Project.

1.9. ACCESS AND PROTECTION

- 1.9.1. Access to the Site shall be limited to location and time of day. Access to areas of the building shall be limited to location and time of day. Refer to Section 27 00 05.70 and conform to requirements.
- 1.9.2. Refer to the security and protection requirements in the "General Conditions" and conform to all requirements.

1.10. DRAWINGS, CHANGES AND INSTALLATION

- 1.10.1. The Drawings are intended to show the general character and scope of the Work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- 1.10.2. 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 right is reserved by the Communications Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no extra cost to the Client.
- 1.10.3. Certain details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the Drawings.
- 1.10.4. The location and size of existing services shown on the Drawings are based on the best available information. The Communications Contractor shall verify the actual location of existing services in the field before Work is commenced.
- 1.10.5. Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Client.
- 1.10.6. 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.

- 1.10.7. Where equipment is shown to be 'roughed in only' obtain accurate information from the Communications Engineer's Representative before proceeding with the Work.
- 1.10.8. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers and all other equipment shown on Drawings (if shown) is diagrammatic.
- 1.10.9. The Communications Contractor, at their expense, shall remedy any Work not installed in correct location (at the sole discretion of the Communications Engineer's Representative). The Communications Contractor is responsible to mark-out their Work and fully co-ordinate with all other trades. Review the Work with Communications Engineer's Representative prior to rough in. Prepare dimensioned layouts of each room prior to rough in for review by Communications Engineer's Representative. Do not proceed with any Work until the Communications Engineer's Representative has reviewed and approved the layout Drawings.
- 1.11. SUBSTITUTIONS AND ALTERNATE PRODUCTS
- 1.11.1. 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.
- 1.11.2. Where supply of the materials may compromise the schedule, the Communications Contractor shall submit a request to use alternate product to the Communications Engineer's Representative. Depending on the circumstance and acting reasonably, the Communications Engineer's Representative may provide written authorisation to substitute the Product. Written authorization shall be obtained before alternatives are purchased or installed.
- 1.11.3. Where a separate price is requested in this document, the Communications Contractor shall prepare quotation(s) to install/provide products and/or systems as outlined. The separate price quotation shall be submitted with the bid response. Instructions and products requested under Separate price sections shall not be considered substitutions or alternate products.
- 1.11.4. The Communications Engineer's Representative's decision regarding the acceptance or rejection of the proposed substitution shall be 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.
- 1.12. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS
- 1.12.1. Materials and equipment provided under this Division shall be new and free from defects.
- 1.12.2. All equipment and material for which there is a listing service shall bear a ULC and/or CSA label.
- 1.12.3. Equipment shall meet all applicable FCC/CRTC Regulations.
- 1.12.4. Materials shall have a flame spread in accordance with local Authorities Having Jurisdiction, and in accordance with the electrical Specifications as part of this project.
- 1.13. DOCUMENT FORMAT
- 1.13.1. 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 supplied and installed for the project. The third part 'Execution' details the requirements for the installation of the specified products. If a product is listed in section 2, the Communications Contractor shall reference sections 1 and 3 for the relevant General information and Execution requirements of that product.

1.14. STATEMENT OF PRICES

- 1.14.1. To form a basis for progress payments the Communications Contractor shall submit a statement of their estimated prices for the various portions of the Work including both labour and materials. The total price of all portions of the Work shall equal the total price of the Work covered under the Communications Division. Submit pricing for applicable sections in the Supplementary Tender Form(s) as provided.

1.15. VALUATION OF CHANGES

- 1.15.1. 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 Communications Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.

- 1.15.2. Contractor shall provide the Communications 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.

- 1.15.3. 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.

- 1.15.4. The following shall not be included in the cost of the work but are covered by the allowance (mark-ups) for overhead and profit:

- .1 The Contractor's head office and site office expenses, including stationary, postage and other office supplies.
.2 The costs of the Communications Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
.3 Use of temporary offices, sheds, small tools, etc., including 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.
.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 Contractor's and Subcontractors' use in the Work. Communications Engineer's Representative will provide one copy of change notice documentation and in the event of re-issue of full size Drawings will provide one print.
.8 The cost of record Drawings and Shop Drawings.
.9 The cost of cleanup and disposal of waste material.
.10 Parking.

- 1.15.5. 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 CCDC2-[latest version] GC 6.2.
- 1.15.6. The maximum percentage fee for mark-ups shall be as stated below.
- 1.15.7. In computing accounts for extras and credits for any Proposed Change, all credits shall be deducted from the total sum of the extras before mark-ups or charges for overhead and profit are added.
- 1.15.8. The Contractor shall 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.
- 1.15.9. Special equipment rental rates will be charged at cost.
- 1.15.10. Permitted Mark-Ups

.1 The following maximum net overhead and profit mark-ups by Contractors will be permitted for extra Work under Change Order or Change Directive:

Cost of Extra Work, not including GST or HST, as applicable	Contractor's Mark-Up on Work of Own Forces (%)	Contractor's Mark-Up on Subcontracted Work (%)
\$0 to \$5,000	10	7
>\$5,000 to \$10,000	10	7
>\$10,000 to \$50,000	7	5
>\$50,000	5	4

.2 The following maximum net overhead and profit mark-ups by Subcontractors will be permitted for extra Work:

Cost of Extra Work, not including GST or HST, as applicable	Contractor's Mark-Up on Work of Own Forces (%)	Contractor's Mark-Up on Subcontracted Work (%)
\$0 to \$5,000	10	7
>\$5,000 to \$10,000	10	7
>\$10,000 to \$50,000	7	5
>\$50,000	5	4

.3 Where a proposed change order includes both credits and extras, overhead and profit mark-ups apply to the net extra or credits, if any, of the entire change.

- 1.15.11. 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.

1.15.12. Labour Rate

- .1 During 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 units column 1 (one). No additional factors will be accepted.
- .2 The hourly labour rate for all changes will be based on a Journeyperson Electrician rate as listed on the Electrical Supplementary Bid Form. The Owner and/or Communications Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be exclusive of overhead and profit. The labour rate will be inclusive of all labour burden charges including: payroll and administrative burdens, all government

payroll burdens, variable labour factors and union or association funds. 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: all supervision, hand tools, warranties, storage, rentals, parking, clean-up, additional bonding, as-built drawings, material sorting/handling/hoisting, project financing, coffee break/rest periods, safety training including safety briefings, WHMIS and the health and safety committee, non-productivity time and site office and consumables.

- .3 At the request of the Owner or the Communications Engineer's Representative, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Communications Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

PROPOSED CHANGE ORDER

Company Name:	CCN #
Address:	Date:
City, Prov.:	Project Name:
Postal Code:	Project Number:
Telephone:	Page Number:
Fax:	Change Order #:
E-Mail address:	
Client 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>
3/4' EMT		150.39 C		5.00 C	
3/4' EMT STL SS CONN		65.97 C		10.00C	
3/4' EMT STL SS CPLG		70.60 C		5.00 C	
3/4' EMT STRAO 1-H		11.24 C		4.00 C	
#8 TO 10 x 7/8" PLAS ANCHOR (3/16)		6.05 C		5.00 C	
#10 x 1" SELF TAPPING SCREW		5.50 C		5.5 0 C	
TOTALS					

Summary

<u>Description</u>	<u>Total Hours</u>
General Materials	
Material Tax (@ 15.000 %)	
Material Total	
JOURNEYPerson (xx Hrs. @ \$xx.00)	
Subtotal	
OVERHEAD AND MARK-UP	
Overhead/Mark-up (@ 10.000 %)	
Subtotal	
Final Amount	

2. Products

2.1. SYSTEM PERFORMANCE

2.1.1. 4-Pair Horizontal Copper Cabling– Data System

- .1 All components of the horizontal data channel shall meet the minimum performance characteristics of:
- .2 Category 6a – 500MHz and a data rate of 10Gb/s, with an outside diameter no greater than 0.27”
- .3 Category 6 – 250MHz and a data rate of 2.4Gb/s

2.2. CERTIFICATION

2.2.1. The acceptable manufacturers for the complete 4-pair horizontal voice and data systems for this installation are listed below.

Manufacturer	Contractor Certification
Belden Incorporated	CSV – Certified Systems Vendor
Panduit Corporation	NCI – NetKey Installer Certified
CommScope Incorporated (Systimax)	VAR – Value Added Reseller

3. Execution

3.1. TERMINATION REQUIREMENTS

- 3.1.1. All copper cabling must be terminated using EIA/TIA 568A configuration, unless noted otherwise.
- 3.1.2. All multimode and single mode Fibre Optic Cabling shall be terminated using field installable connectors unless expressly written in this document. Splicing techniques such as mechanical and heat shrink fusion splicing shall be utilized where specified.

3.2. SITE EXAMINATION

- 3.2.1. Prior to submitting their tender response, the Communications Contractor shall perform a site survey (when available) to familiarise themselves 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.

- 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.

- Communications 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.

- 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).

- Communications Engineer's Representative - Joshua Blizzard
Smith + Andersen
100 Sheppard Avenue East
Toronto, ON M2N 6N5

- Cut Over - The live date(s) when the Client will occupy the space as indicated by date and/or phasing.

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.
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 and install.
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
GENELEC	- 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
ft ²	-	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
PSELFEXT	- 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
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 Communications 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 Communications 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-87-640-	Optical Fibre Outside Plant Communications 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/EIA	
455-C	Optical Fibre Test Procedures.
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).
472DAAA-93	Detail Specification for All-Dielectric Optical Fibre Communications Cable for Outside Plant Use, Containing Class Ia, 62.5 mm Core Diameter/125 mm Cladding Diameter/250 mm Coating Diameter Optical Fibre(s).
492AAAA-09	Detail Specification for 62.5-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
492AAAB-09	Detail Specification for 50.0-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
492CAAA-98	Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communications Systems.
568.1-D	Commercial Building Telecommunications Cabling Standard: General Requirements.

568-C.2	Commercial Building Telecommunications Cabling Standard: Balanced Twisted Pair Cabling.
568.3-D	Commercial Building Telecommunications Cabling Standard: Optical Fibre Cabling Components Standard.
569-D	Commercial Building Standard for Telecommunications Pathways and Spaces including all addenda
598-D	Optical Fibre Cable Color Coding, latest version
570—D	Residential Telecommunications Infrastructure Standard.
604-5-E	FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO
606-C	Administration Standard for Telecommunications Infrastructure
607-C	Telecommunications Grounding (Earthing) and Bonding for Customer Premises
758-B	Customer Owned Outside Plant Telecommunications Cabling Standard.
862-B	Structured cabling infrastructure Standard for Intelligent Building Systems
942-B	Telecommunications Infrastructure Standard for Data Centers
1005-A	Telecommunications Infrastructure Standard for Industrial Premises
CSA	
C22.1-18	Canadian Electric Code Part I: Safety Standards for Electrical Installations.
C22.2 No. 182.4-M90	Plugs, Receptacles, and Connectors for Communication Systems. R2015
C22.2 No. 214-17	Communications Cables.
CAN/CSA-C22.2 No. 0-10	General Requirements, Canadian Electrical Code, Part II (latest version)
CAN/CSA-C22.2 232-17	Canadian Electric Code Part II: Optical Fibre Cables.
T527-94	Grounding and Bonding for Telecommunications in Commercial Buildings.
T528-93	Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings
T529-95	Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.
T530-99	Commercial Building Standard for Telecommunications Pathways and Spaces (latest version)
OTHER	
CAN/ULC-S115:2018	Standard Method of Fire Tests of Firestop Systems.
CAN/ULC S101-14	Standard Method of Fire Endurance Tests of Building Construction and Materials.
CAN/ULC S102:latest version	Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies.
CENELEC EN 50173	Performance Requirements for Generic Cabling Systems.
CLC	Canada Labour Code, Part II Occupational Health and Safety, and Provincial and Local Health and Safety regulations

ICEA S-90-661	Category 3, 5, and 5e Individually Unshielded Twisted Pair Indoor Cables (with or without an overall shield) for use in General Purpose and LAN Communication Wiring Systems Technical Requirements
IEC 60603-7, 3.2 (latest version), Part 7	Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors
ISO/IEC IS 11801-1:2017(E)	Generic Cabling for Customer Premises.
NEMA WC 63.1-latest version	Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System.

- .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 Client.

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. These items shall be removed from premises when no longer required.

1.1.3. Cutting, Patching and Repairing

- .1 It is the responsibility of the Communications Contractor to perform all cutting, patching and repair related to the Communications Cabling work including any penetrations through walls or floors.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. CODE, STANDARD AND REGULATION COMPLIANCES

- 3.1.1. All cables and components shall be installed and terminated in accordance with CSA, ANSI/EIA/TIA-568B and its Amendments as well as UL/ULC Guidelines. Particular attention shall be given to maintaining the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI. Cables shall be combed and bundled in a neat and organised manner. The Communications Engineer's Representative will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Communications Contractor's expense. The Communications Contractor shall co-ordinate with the Communications Engineer's Representative prior to termination in any Telecom Room.

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

END OF SECTION

27 00 05.50 Contract Documents

1. General

1.1. WORK INCLUDED

1.1.1. Drawings List

- .1 Refer to the Index for a list of drawings that shall be used for preparation of bids and construction.
- .2 A hard copy of the drawings will be supplied to the Cabling Contractor for Construction.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. COORDINATION

- 3.1.1. Carefully examine work and Drawings of all related trades and thoroughly plan the work so as to avoid conflict or interference with other services. Report defects that would adversely affect work. Do not commence installation until defects have been corrected.
- 3.1.2. Co-ordinate work of this Contract such that items will properly interface with the work of other Contracts. Prepare installation drawings of critical locations and submit to the Communications Engineer's Representative for review.

END OF SECTION

27 00 05.60 Administrative Requirements

1. General

1.1. WORK INCLUDED

1.1.1. Submittals – Drawing Documentation and Cable Test Results

- .1 The Communications Contractor shall be provided with drawing(s) for construction on which the Communications Contractor shall clearly mark all changes and deviations during the construction process, which shall include 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. The as-built drawing(s) shall also include all additional cables installed during the project. The Communications Engineer's Representative shall have 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, the Communications Contractor shall forward to the Communications Engineer's Representative two sets of Drawings indicating all such changes and deviations for review within 5 business days of the completion of the project.
- .2 The Communications Contractor shall supply (temporary hand-marked) as-built Drawings to Communications Engineer's Representative for Client use 3 business days prior to cut-over.
- .3 The Communications Contractor shall request (via email) from the Communications Engineer's Representative a soft copy of the Drawings for use by the Communications Contractor in preparation for record (as-built) Drawings. The Communications Contractor shall be responsible for updating the soft copy drawing(s) with correct as-built information (i.e. cable numbers, outlet locations, rack/backboard elevations, etc.) in digital format using AutoCAD 2004 or better.
- .4 All changes to drawing(s) shall follow conventional Engineering Draft Standards. All Voice, Data and Coaxial outlet locations shall be identified with proper designation.
- .5 If the Communications Contractor cannot comply with this requirement, Smith + Andersen will transfer all hand drawn as-built to AutoCAD. The cost for this service shall be based on per diem rates at time of completion. The Communications Contractor shall be responsible for the costs associated with this work.
- .6 The Communications Contractor shall print / plot two sets of as-built Drawings at no extra cost. Final as-built print(s)/plot(s) shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.) and shall be delivered to Smith + Andersen for final review and delivery to the Client.
- .7 The Communications Contractor shall 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. An authorized person for the Communications Contractor must sign the entire report. The Communications Contractor is also required to supply 1 soft copy on CD(s) in the tester's native format, along with the appropriate software to read the test results. These files shall be provided on a CD(s) separate from the record Drawings CD(s).
- .8 The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) and cable test results are provided.

1.1.2. Submittals – Testing and Commissioning

- .1 Provide testing and commissioning documentation for all items and their related components to the Communications Engineer's Representative prior to the completion

of the project or at the Communications Engineer's Representatives request. Include maintenance manuals and operating instructions for Client's staff use.

1.1.3. Submittals – 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 Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
- .3 Each Shop Drawing or catalogue sheet shall be stamped and signed by the Communications Contractor to indicate that he has checked the drawing for conformance with all requirements of the Drawings and Specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has 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 communications co-ordination is complete before submitting 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, Shop Drawings shall be supplemented 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 Communications Contractor and 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 Communications Contractor.

1.1.4. 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 Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and Drawings that these authorities may require.

1.1.5. Substitutions and Alternate Products

- .1 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.

- .7 Reason(s) for the request.
 - .2 Substitution submissions do not relieve the Communications Contractor from the obligation of preparing and submitting a tender response 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.
 - .3 Where a separate price is requested in this document, the Communications Contractor shall prepare quotation(s) to install/provide products and/or systems as outlined. The separate price quotation shall be submitted with the bid response.
- 1.1.6. Scheduling
- .1 Within one week of award of the contract, the Communications Contractor shall submit a formal project schedule to the Communications Engineer's Representative showing start and finish dates of major tasks as denoted by system, backbone cabling, horizontal cabling, rack and cabinet installation, material order and delivery to site and testing.
 - .2 Updated schedules shall be submitted as periodically requested by Communications Engineer's Representative.
- 1.1.7. Cleanup
- .1 The Communications Contractor is responsible for keeping the site and surrounding area clean, safe and free from debris at all times. All debris must be removed from the site on a daily basis. The costs for cleaning are the responsibility of the Communications Contractor.
 - .2 Upon completion of the work and before acceptance and final payment will be made, the Communications Contractor shall 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.
 - .3 Before acceptance by the Communications Engineer's Representative, all the equipment and cabling must be cleaned and tested.
- 1.1.8. Review and Testing Requirements
- .1 The Communications Engineer's Representative must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.
 - .2 The Communications Engineer's Representative shall be invited to witness field testing and shall be notified of the start date of the testing phase 5 business days before testing commences. Upon completion of the testing by the Communications Contractor the Communications Engineer's Representative may ask the Communications Contractor to perform a random test of up to 10% of the links. The Communications 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, the Communications Contractor under supervision of the Communications Engineer's Representative shall repeat 100% testing. The cost of the labour required for the testing as well as the cost for the supervision by the part of Communications Engineer's Representative shall be borne by the Communications Contractor.
- 1.1.9. Submittals – Connectivity Database

- .1 The Communications Contractor shall prepare separate Data and Voice Connectivity Databases in Microsoft Excel spreadsheet format that includes the following:
- .2 Data and/or Voice (VoIP) - For data connectivity, this shall include but shall not be limited to workstation identification or number, horizontal Data cable number, active equipment port and copper and/or fibre backbone cable/strand.
- .3 The Communications Contractor shall only be required to provide this information when the Communications Contractor is responsible for the installation of patching/cross-connect of the data and/or voice systems.
- .4 One electronic copy shall be supplied to the Communications Engineer's Representative.

2. Products

2.1. NOT INCLUDED IN THIS SECTION.

3. Execution

3.1. NOT INCLUDED IN THIS SECTION.

END OF SECTION

27 00 05.70 Project Specific Requirements

1. General

1.1. WORK INCLUDED

1.1.1. Cable Installation

- .1 The Communications Contractor shall assume 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 schedule.

1.1.2. Floor/Ceiling Tiles

- .1 The Communications Contractor shall be responsible for the removal and re-installation of all floor/ceiling tiles in areas affected by their work. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise the Communications Contractor shall remove and re-install the tiles after their work is complete.
- .2 Any damage to ceiling tiles during the installation of any work described in this document shall be the responsibility of the Communications Contractor. Damages include chipping, breaking or soiling. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Project Manager and/or the Communications Engineer's Representative.
- .3 The Communications 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 The Communications Contractor shall include for a total of 16 hours cut over support, to be used at the discretion of the client/Engineer's Representative. The technician shall be available to provide services to the Client as required. This may involve additional testing or Move, Add, Change activity. Any additional materials used shall be addressed separately.
- .2 The Communications Contractor shall schedule their 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 Communications Contractor's Tender bid.

1.1.4. Safety of Persons and Property

- .1 The Communications Contractor shall comply with all laws, ordinances, rules, regulations, and policies of the Client 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 No open flames/smoking shall be permitted without prior written approval of the Client.

- .5 The Communications Contractor is responsible setting up and removal of all signage and safety measures to ensure that other trades and non-trade personnel are safe from work of the Communications Contractor.
- 1.1.5. Access to Site
 - .1 The Communications Contractor shall be responsible for coordinating site access with the Project Manager and/or Client as determined during the initial project meeting.
- 1.1.6. Identification
 - .1 All Communications Contractor personnel shall be clearly identified by either uniform or company ID. In addition, the Communications Contractor may be required to wear Client provided ID for required card access locations or identification. All Client ID(s) must be returned daily or at the end of the project as determined by the Client.
- 1.1.7. Emergency Facilities
 - .1 The Communications 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 The Communications Contractor shall be responsible for complete delivery, handling, and installation of all materials used in the performance of the work.
 - .2 Arrange for the delivery of Client furnished equipment/materials related to this Specification and related items, including unloading of supplier's truck, elevator scheduling and placement on Client premises as indicated on Contract Drawings.
- 1.1.9. Product and Tools Storage Requirements
 - .1 The Communications Contractor shall be responsible for complete storage and handling of all materials used in the performance of the work.
 - .2 The Communications Contractor shall be allowed to store job boxes on the site during construction. The tools and the job box shall be the responsibility of the Communications Contractor. The Client and their representative shall be in no way responsible or liable for any tools of the Communications Contractor.
- 1.1.10. Confined Spaces
 - .1 Where work is performed in a confined space, the Communications Contractor shall comply with all code related and Client specific safety requirements.
- 1.1.11. Coordination with Occupants
 - .1 The Communications Contractor shall be responsible for co-ordinating all work with the Client/tenant of the floor space for their daily work.
- 1.1.12. Project Meetings
 - .1 The Communications Contractor shall attend site meetings when requested by the Communications Engineer's Representative and/or the Project Manager. Regular meetings may occur once per week at the Communications Engineer's Representative's and/or the Project Manager's discretion.
 - .2 The Communications Contractor shall attend weekly 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 The Communications Contractor shall issue a status report at the weekly project meeting including status of: progress, project completion for phases, material ordering and delays.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. The Communications Contractor shall 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 Communications 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 Communications Contractor. All damage shall be repaired, or at the Client's request, the equipment shall be replaced at no extra charge to the Client.

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 to the Code Requirements.
- .3 Moisture seals as well as fire and smoke seals shall be required for all floor penetrations in Laboratories and Operating Rooms in Hospitals, Universities and Schools.
- .4 The Communications Contractor shall 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 Communications Contractor.
- .5 Supply and install Fire Stop pillows for existing cable tray penetrations through firewalls.
- .6 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.
- .7 Supply and install 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).
- .8 All fire stopping shall maintain a minimum one hour rating and shall meet applicable Federal, Provincial and Local building codes.
- .9 All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the Standards.
- .10 Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.
- .11 All Smoke Seals selected for use shall comply with Standards.
- .12 Where moisture seals are required for floor penetrations in Operating Rooms, Morgues, and Laboratories in Hospitals, Universities and Schools, the Fire Stop Materials selected shall be compatible with Formalin.
- .13 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 The Communications Contractor shall 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 All service entrance conduits through building shall be sealed or resealed upon cable placement. Spare conduits shall be plugged 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 Openings for cable trays shall be sealed 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. The Communications Contractor shall 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 Communications 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 The Communications Contractor shall allow for cable removal in their bid response, based on the scope of work indicated in this section and on any associated demolition drawings.
- .2 The Communications Contractor shall confirm with the Communications Engineer's Representative prior to any cable being removed. The Communications Contractor shall forward a schedule indicating the locations and times for cable removal to the Communications 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 Client.

1.1.2. Cable and Equipment Removal

- .1 The extent of demolition work to be included in this contract shall be delineated in included demolition drawings and associated detail drawings.
- .2 Where identified on drawings, the Communications Contractor shall 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. The Communications Contractor shall 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 The Communications Contractor shall 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 cost of premium time in Tender price for work during nights, weekends or other time outside normal working hours necessary to maintain all Telecommunications services in operation.
- .7 Scope of Demolition:
 - .1 Work shall include for removal, relocation and reinstallation of Telecommunications devices/systems/infrastructures in the areas noted on the drawings. this shall include, but not necessarily be limited to:
 - .1 Disconnecting, removal and/or reinstallation of all Telecommunications devices/systems/infrastructures to accommodate new work. Refer to relevant electrical, architectural, structural and mechanical 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 All Telecommunications devices/systems/infrastructures shall be traced and identified by the Contractor for review by the Project Manager and/or Owner in order to determine if services are to remain or to be removed. Once identified, the Communications Contractor shall remove those as directed.
- .5 Disconnect and remove all existing services, devices and wiring materials which are abandoned.
- .8 Disposal of Materials
 - .1 All material removed from the site shall be disposed of 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. Do not resume work in affected area without approval from the project manager.
- 2. Products
 - 2.1. NOT INCLUDED IN THIS SECTION
- 3. Execution
 - 3.1. CABLE IDENTIFICATION
 - 3.1.1. Prior to removal of Communications Cabling, the Communications Contractor shall identify all existing non-active cabling (as well as active cabling to remain), and verify the location and extent of removal with the Client. The Communications Contractor shall be required to 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. The Communications Contractor shall turn over to the Client all racks, cabinets, accessories, patch panels and voice connectivity hardware for re-use. If items are not to be re-used, the Communications Contractor shall confirm disposal with the Project Team prior to disposal.
 - 3.2.3. The Communications Contractor shall dispose of on a daily basis all cabling and components that are removed. Include all costs of removal and disposal in the bid 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 drawings shall be maintained in operation during the construction phase. The Communications Contractor shall be required to provide new wiring for any existing systems to remain so that the existing systems do not interfere with new work. The Communications Contractor shall 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 circuits 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 circuits within the renovated area and adjacent areas. Mark this information on a set of drawing prior to any work commencing as these circuits 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/wiring being reinstalled in areas being renovated for proper operation and repair as necessary before being put back into service.
- 3.3.6. The Communications Contractor to verify operation of all existing devices and report any discrepancies to the Project Manager 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, the Communications Contractor shall 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 26.00 Grounding and Bonding for Communications Systems

1. General

1.1. WORK INCLUDED

1.1.1. Applicable Codes & Standards

1.1.2. Provide grounding & bonding in accordance with good industry practices and in accordance with the following Codes and Standards:

- .1 CSA Standard C22.2 No.41 latest version – Grounding & Bonding Equipment
- .2 CSA Standard T527 (ANSI/TIA/EIA-607-C)
- .3 CSA Standard T 530-99 - Telecommunications Pathways and Spaces
- .4 ANSI/EIA/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers
- .5 Local Codes & Bylaws
- .6 BICSI requirements

2. Products (Refer to Electrical Specifications for Electrical Codes and Building Codes)

2.1. ALL COMPONENTS OF THE GROUNDING & BONDING INFRASTRUCTURE SHALL BE BY PANDUIT CANADA.

2.1.1. Typical part numbers are as follows;

- .1 Rack Grounding Strips – Part# RGS134-1Y
- .2 Rack Jumper Kits – Part# ACG24K
- .3 Thread forming screws shall be used. Part # RGTS-CY or RGTSM6-C
- .4 Bonding screws. Part# RGTBS-C or RGTBSM6-C.

2.1.2. A Green Jacketed #6 AWG Stranded Copper Conductor shall be used to ground the Telecommunications grounding system to all;

- .1 Telecommunications Cabinets
- .2 Telecommunications Racks
- .3 Telecommunications Metallic Pathways including Cable Tray, Conduit, etc.
- .4 Metallic sheath of all Backbone Cables (use appropriate manufacturer's bond clamp)
- .5 All Telecommunications enclosures including consolidation point enclosures, building entrance protection panels, etc.

3. Execution

3.1.1. The Owner shall determine if the grounding conductor shall be placed near the bottom or top of the Telecommunications Cabinets/Racks. The contractor shall not proceed to install the conductor(s) until direction from the Owner has been given. The contractor shall ensure that complete metal-to-metal contact is made when grounding to painted or powder coated metal surfaces.

- 3.1.2. A properly sized Copper Grounding Busbar and associated hardware shall be installed in the Telecommunications Room by the Electrical Contractor. The Busbar shall be permanently connected to the building ground system by the Electrical Contractor.
- 3.1.3. Grounding & Bonding Infrastructures installed by the Contractor shall not interfere with the existing grounding practices within the customer premises.
- 3.1.4. The Contractor shall provide One (1) Rack Grounding Strip c/w #6 AWG Green Grounding Wire connection back to grounding Busbar for each Telecommunications Rack or Cabinet as depicted on room layouts.
- 3.1.5. The Contractor shall provide One (1) Rack Jumper kit for each piece of network equipment as depicted on Rack Elevation Drawings.
- 3.1.6. The Contractor shall utilize thread forming screws, bonding screws & any other hardware necessary to complete the ground system.

END OF SECTION

27 05 28.00 Pathways for Communications Systems

1. General

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in Contract Documents. The Communications Contractor shall 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 as specified in this document.
- 1.1.2. The Communications Contractor shall not use any mechanical or electrical fittings to support the Telecommunications cabling. All Telecommunications cabling shall be independently supported.
- 1.1.3. The Communications Contractor shall 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. A minimum of 75 mm 3" (in) of clear vertical space above the ceiling tiles shall be maintained.
- 1.1.4. The Communications Engineer's Representative must approve 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, Communications 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. The Communications Contractor shall supply and install cable support for the distribution of horizontal and backbone cables where conduit or cable tray has not been provided. Cable supports shall be manufactured by Erico, Panduit, or equivalent and sized as per manufacturer recommendations.

2.1.2. Non-continuous cable supports shall be utilized up to the maximum density of cables permitted, as specified by the manufacturer.

2.1.3. Panduit J-Pro, J-Mod, or equivalent cable supports shall be used where ceiling space rating dictates. J-Pro plenum part numbers are shown for reference below. Substitute equivalent J-Mod product codes for similar product when required.

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

2.1.4. The size of J-hooks/support shall suit quantity of cables in runs used for distribution.

2.1.5. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.

2.2. VELCRO TIE-WRAPPS

2.2.1. It should be noted that only Velcro tie-wraps shall be acceptable. Under no circumstance shall plastic tie-wraps be used.

Panduit
HLS/HLM-15R0 (Black)
Or equivalent

2.2.2. If plastic tie-wraps are used the Communications Contractor shall be required to 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. Panduit part number: T50F-CX.

2.3.3. Or 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;

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. All cables and components shall be installed and terminated 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 16 Drawings, unless otherwise noted. Communications Contractor is responsible for determining these requirements based on Communications and/or Electrical Drawings.

3.2.2. Caddy hangers shall be installed at 4' intervals (maximum). Cables shall be run such that sag between supports does not exceed 4". Secure all cables to J-hooks/supports with Velcro tie-wraps. Cables shall be combed and dressed for all visible portions of the install. The above noted conditions will be strictly checked and the Communications Contractor will be required to comb and redress any cables that are unsatisfactory at no additional cost.

3.2.3. The Communications contractor shall 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. The Communications Contractor is responsible for coordinating the best time to install the supports with the Project Manager. After hours work may be required for this portion of the work.

3.2.6. Supports shall be sized to accommodate the number of cables in each run. Other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling shall be included.

- 3.2.7. In the Cable Support Hanger System, each individual run or pathway shall not contain more than fifty (50) UTP horizontal cables. Where these situations arise, provide an additional hanger pathway to divide the cable bundle.
- 3.2.8. The Cable Support Hanger System shall be completely and independently supported from the structural ceiling or walls (concrete slab/deck) and shall not be supported in any way by the suspended ceiling. Anchors for hangers must not be drilled into post tensioned beams under any circumstances. The Communications Contractor shall not use Hilti Pneumatic hammers. All anchors must be drilled into slab.
- 3.2.9. The Communications Contractor must minimize the disturbance or removal of 'fire spray' insulation during installation of cable supports.
- 3.3. VELCRO TIE-WRAPS
- 3.3.1. Velcro tie-wraps shall be used 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. Velcro tie-wraps shall also be used 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. CABLE DISTRIBUTION
- 3.5.1. Ensure ANSI/EIA/TIA-568.1-D installation practices are followed for Indoor cable distribution and ANSI/EIA/TIA-758-B installation practices are followed for Outdoor cable distribution.
- 3.5.2. Station personnel at each access point (i.e. Handhole, maintenance hole, etc.) to observe and lubricate the cables being pulled. Submit tension pull calculation for installation of cables to Communications Engineer's Representative.
- 3.5.3. 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. The tension limit shall be set 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 Communications Engineer's Representative, to prevent over tension on the cable.
- 3.5.4. Minimum bend radius shall be as per the manufacturer's recommendations.
- 3.5.5. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.
- 3.5.6. Protect exposed cable ends from moisture ingress.
- 3.5.7. Cable passing through maintenance holes to have sufficient slack for expansion/contraction and shall be mounted with clips to prevent sagging.

3.6. DUCT AND CONDUIT

- 3.6.1. 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 communications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Communications Engineer's Representative of the problems encountered.
- 3.6.2. Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. Apply manufacturer's recommended lubricant to cables to reduce friction between the cable and the duct. 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 Communications Systems

1. General

1.1. WORK INCLUDED

1.1.1. Labelling

- .1 The Communications Contractor shall confirm the proper cable designations with the Communications Engineer's Representative prior to installation.
- .2 CSA T528-93 (ANSI/EIA/TIA-606-C) colour codes shall be adhered to.
- .3 Labelling schemes shall be confirmed with the Communications 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

- .1 The cable labelling for Horizontal Voice/Data cables and IDC Blocks / Patch Panels shall be as follows:
- .2 TX.Y where
- .3 T indicates type of cable: Voice (V) or Data (D).
- .4 X indicates the floor,
- .5 Y indicates the Cable Number (numeric) 001... highest cable number.
- .6 Example: D7.017
- .7 D indicates data,
- .8 7 indicates 7th floor,
- .9 .017 indicates the 17th Cable.

2. Products

2.1. LABELLING

- 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. Cable Labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times.
- 2.1.3. Panduit Part# LS8E or Equivalent
- 2.1.4. Easy-mark labeling software. Part# PROG-EMCD or Equivalent.

3. Execution

3.1. LABELLING

- 3.1.1. All labels must be mechanically printed using a laser printer. Hand-written labels are not permitted.

3.1.2. Provide 25% additional labels to be left in each telecommunications room on site for future growth.

3.2. LABEL LOCATIONS

3.2.1. 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/Communications outlet faceplates.
- .5 Each end of each Telecommunications Conduit.

END OF SECTION

27 08 00.00 Commissioning for Communications Sections

1. General

1.1. WORK INCLUDED

1.1.1. General Testing Requirements

- .1 100% of the installed cabling links must be tested and must pass the requirements of the Standards as defined within this document. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.
- .2 All deficiencies must be corrected before the Communications Engineer's Representative will provide a certificate to release the Holdback on the project.
- .3 The Communications Contractor is required to submit a soft copy of test results in Access, Paradox or any other ODBC compatible Database formats.
- .4 Test Patch Cords to portable tester must be designed for testing by the manufacturer. Field assembled Patch Cords are not acceptable. Field testers must use the appropriate jack/tester adapter specified for use with the cabling jack(s) specified within this document.
- .5 The Communications Contractor shall produce a test report based on the cable schedules. The report should 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. A sample of the test report must be submitted to the Communications Engineer's Representative for approval. The entire report must be signed by an authorised person for the Communications Contractor at the completion of the project.

1.1.2. Copper Cabling Test Requirements

- .1 Every cabling link in the installation shall be tested (as required by the Cabling specified) in accordance with the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA-568.1-D.
- .2 The installed twisted-pair horizontal links shall be tested from the Telecommunications Room to the workstation against the "Permanent Link" performance limits Specification as defined in ANSI/TIA/EIA-568.1-D.
- .3 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall 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 The test equipment shall comply with or exceed the accuracy requirements for enhanced level II and/or level III field testers (according to Cabling specified) as defined in TIA-568-D; Annex I: Section I.4. 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 Table I.4 of Annex I of TIA/EIA-568.2-D.
- .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. The Communications Contractor shall provide proof that the interface has been calibrated within the period recommended by the Vendor. To 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. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-D; Annex I: Section I.2.2).

1.1.3. Copper Cabling Performance Test Parameters

- .1 The test parameters for Cat 5e are defined in ANSI/TIA/EIA Standard 568.1-D; Section 11.2.4 as well as in Annex I; Section I.2.1 "Parameters to be reported". The test of each Cat 5e link shall contain all of the following parameters as detailed below. In order to pass the link test all measurements (at each frequency in the range from 1 MHz through 100 MHz) must meet or exceed the limit value determined in the above-mentioned Cat 5e Standard. In addition, the test parameters for Cat 6 are defined in TIA Cat 6 Standard, which refers to TIA/EIA-568.2-D. 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 250 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 NEXT/FEXT
 - .5 ACR
 - .6 Return Loss
 - .7 ELFEXT, PSELFEXT
 - .8 Propagation Delay, Delay skew
 - .9 PSNEXT, PSACR
- .3 Permanent link testing of all horizontal and backbone cables is to 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
 - .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. Copper Cabling Test Result Documentation

- .1 The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.
 - .2 The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, review and archiving of these test records. A guarantee must be made 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 A paper copy of the test results shall be provided 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
 - .4 The date and time the test results were saved in the memory of the tester
 - .4 General Information shall be provided in the electronic data base containing the test result information for each link:
 - .1 The identification of the Client 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
 - .7 The revision of the tester software and the revision of the test Standards database in the tester
 - .5 The detailed test results data to be provided in the electronic database for each tested Copper Cable must contain the following information
 - .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
 - .4 The test results information must contain information on each of the required test parameters that are listed in this document.
- 1.1.5. Warranty and Certification Requirements
- .1 The Communications Contractor is required to provide a minimum of a 2-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 communications cabling system.
 - .2 The Communications Contractor is required to 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 communications cabling system.
 - .3 Response time for Warranty items shall be 24 hours. The Communications Contractor may be required to repair deficient Cabling Solution components outside regular

working hours. Bidders shall include a statement of Warranty terms and conditions with their Bid Response.

- .4 Provide a manufacturer Warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer Specifications. A framed certificate will be acceptable.
- .5 Upon request and at no additional cost to the Client the Communications Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.
- .6 All documentation including the certificate must be in English and French, and shall be submitted to the Communications Engineer's Representative for signed acceptance prior to their production.

2. Products

2.1. ACCEPTABLE COPPER TESTERS

- 2.1.1. Acceptable portable UTP test manufacturers include: HP/Agilent, OMNI Scanner and Fluke DSP-4000.

2.2. WARRANTY AND CERTIFICATION

- 2.2.1. Provide to client, one system certification per project.

3. Execution

3.1. WARRANTY AND CERTIFICATION REQUIREMENTS

- 3.1.1. The Communications Contractor shall forward the Structured Cabling Solution certification request form(s) to the proper authority and ensure that a Plaque is issued to the Client along with the Structured Cabling Solution user manual. The Communications Contractor will provide a certification number within two weeks of award of this project
- 3.1.2. The Communications Contractor will provide letter(s) of Certification within two weeks of the date of substantial performance of the contract of the project to the Communications Engineer's Representative. This document will include the following: verification of the performance of the installed system, identification of the installation by location and project number and a copy of the Warranty.
- 3.1.3. Upon award of contract, the Communications Contractor shall forward copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the project to Smith + Andersen's office within 7 days of the award of contract. Provide a copy of the form with Specification submission.

END OF SECTION

27 11 16.00 Communications 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. Plywood Backboards

- 1.1.3. Use plywood backboards for mounting of Voice fields, Data fields, Wall Mount Racks, Wall Mount Brackets, Wall Mount Cabinets, Swing-out Racks, termination of horizontal and backbone cables, or for any other use as specified in the scope of work and/or on drawings including but not limited to for use by others. Refer to detail drawings for location of backboards. The Cabling Contractor shall install all new backboards, unless otherwise noted.

1.1.4. Communication Racks and Cabinets

- .1 All wall mount brackets, racks, cabinets and components shall be supplied and installed by the Communications Contractor as indicated in this document and on the Contract drawings.
- .2 All racks, cabinets, wall mount brackets and components provided shall be 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. Hammond Manufacturing
 - 2. D.L. Custom
 - 3. Electron Metal
 - 4. Panduit
 - 5. Belden
 - 6. R.F. Mote

1.1.5. Cabling

- .1 Where cabling and related products are listed under Part 2: "Product" of this Section, the Communications Contractor shall reference the General requirements and the

Execution requirements as applicable under Sections 27 13 13.00, 27 13 23.00, 27 15 00.16 and 27 15 00.19.

2. Products

2.1. WALL MOUNT COMMUNICATIONS CABINET

2.1.1. Wall mounted 482 mm (19") double swing out cabinet to accommodate a minimum 28 standard EIA vertical rack positions shall be used.

2.1.2. Fully welded, fabricated from a minimum of 16GA. (0.060") steel.

2.1.3. The shall have the following product features:

- .1 Lexan front door.
- .2 Solid side panels
- .3 10-32 tapped mounting angle style
- .4 Hinged cabinet body.
- .5 Minimum of one (1) 75 C.F.M or greater cooling fan.
- .6 Vertical cable management panels with hinged doors with nonmagnetic closing mechanisms
- .7 One (1) dual bolt ground lug

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

2.2. COMMUNICATIONS RACK & CABINET COMPONENTS

2.2.1. 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.
- .4 Install one horizontal cable manager per rack plus an additional one for every patch panel and every network switch (assume 48 port switches, one port for every horizontal cable installed).

2.2.2. 30A, Shielded Cord Horizontal 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 6 NEMA 5-20 output receptacles and come with a minimum of 3m 10' (ft) cord and NEMA L5-30 input plug.
- .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".

- .6 Each wall mount cabinet/bracket shall be equipped with a minimum of one power bar unless otherwise noted.

2.3. PLYWOOD BACKBOARDS

2.3.1. The Communications Contractor shall supply, install and layout the Plywood Backboard(s) as required, unless otherwise noted. Backboards shall be constructed of 4' x 8' (3/4") plywood sheet(s) as noted on drawings, one side good. The plywood sheets shall be placed vertically (unless otherwise noted), and shall be painted with 2 coats of white fire retardant non-conductive paint.

2.3.2. Flush Backboards

2.3.3. Backboards shall be used for wall mounted racks, wall mounted cabinets, wall mount brackets, telephone equipment, service provider equipment, lightning protection, horizontal cables, riser cables, IDC punch down blocks, and/or any other use as identified in the scope of work for this project, including for use by others. Install flush backboards where required as shown on drawings.

3. Execution

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

3.1.1. Properly secure the racks on top of the finished floor and wall within the Telecommunications Room. 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 Communications wall mount brackets, racks and cabinets.

3.1.3. All Communications rack and cabinet components shall be provided by the Cabling Contractor as per the detail drawings. The Communication Contractor shall provide (including levelling and ganging) all Racks, Cabinets and their components for a complete functioning system.

3.1.4. Vertical Power bars are to be mounted on the rear right side of the rack with the cord end located at the top of the rack. Horizontal power bars shall be mounted as shown on rack elevation drawings.

3.1.5. All wall mounted equipment (i.e. rotating rack & wall mount cabinet) shall be secured to 3/4" G1S CANPLY Exterior Grade plywood (4' x 8' sheet). Plywood shall be provided by the cabling contractor unless noted otherwise.

END OF SECTION

27 11 19.00 Communications Termination Blocks and Patch Panels

1. General

1.1. WORK INCLUDED

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

2. Products

2.1. COPPER PATCH PANELS

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

2.1.2. 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.

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

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

2.1.5. 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.

2.1.6. Color: Black

3. Execution

3.1. NOT USED

END OF SECTION

27 11 23.00 Communications Cable Management and Ladder Rack

1. General

1.1. WORK INCLUDED

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

1.2. CABLE INSTALLATION

2. Products

2.1. NOT USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. The Communications Contractor shall 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 Communications 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 Communications Contractor. All damage shall be repaired or at the Client's request, the equipment shall be replaced at no extra charge to the Client.

END OF SECTION

27 15 00.19 Data Communications Horizontal Cabling

1. General

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in Contract Documents. The Communications Contractor shall use pathways (by Electrical Contractor) to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use J-hooks/cable support specified in this document.
- 1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.
- 1.1.3. The Communications Contractor shall ensure ANSI/EIA/TIA-568.2-D installation practices are followed. Install horizontal cables in accordance with manufacturer's specifications ensuring that proper installation techniques are adhered to.
- 1.1.4. The Communications Contractor shall terminate all pairs of cable at each cable end.
- 1.1.5. Inform the 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 Engineer's Representative shall determine the quality of workmanship during installation. Cables that have not been properly installed will be reinstalled by the Communications 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 Communications 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 Communications 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
WAP	Blue

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 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. The Communications Contractor shall not splice any cables for any reason, unless prior consent is given by the Engineer's Representative.

3.2. HORIZONTAL CABLE DISTRIBUTION

3.2.1. 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.

3.2.2. Follow proper installation and termination practices for Category 3, 5, 5e, 6, 6A 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.

3.2.3. All horizontal cables shall be bundled on the Telecommunications Racks using Panduit Velcro straps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes where applicable.

3.2.4. Bundles shall be tie-wrapped in Telecommunications rooms, at a maximum of 203 mm 8" (in) separation and shall contain no more than fifty (50) cables to eliminate any excessive stress on the cable jackets.

3.2.5. 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.

3.2.6. 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.

3.2.7. Communications Contractor will be required to route/install Telecommunications cabling in systems furniture, lab casework furniture & mill work as denoted on floor plans.

3.2.8. Avoid scraping, denting or otherwise damaging cables before, during or after installation. The Communications Contractor shall make every effort to protect all exposed cabling from other trades during construction phase until cables can be placed in final pathway. The Communications Contractor without any additional compensation shall replace damaged cables.

- 3.2.9. Provide Data cables to each outlet indicated on the drawings. The Communications Contractor shall refer to the legends on the drawing to determine the number of cables to each outlet location.
- 3.2.10. Terminate test and label each cable in accordance to the parameters stated in this specification document.
- 3.2.11. Ground all cables and components to manufacturer's specifications and standard practices.

END OF SECTION

27 15 43.00 Communications Faceplates and Connectors

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS 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 Communications receptacles are ganged together, cover plates shall be supplied and installed by the Electrical Contractor, unless otherwise noted. Where Communications receptacles are stand alone or separate from Electrical receptacles, cover plates shall be supplied and installed by the Communications Contractor.

2. Products

2.1. EIGHT-POSITION MODULES

2.1.1. The eight- position modules must be matched appropriately with the cables to ensure that end to end Vendor 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 M Ω 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	Location
WAP	White	As per Drawing	Telecom Room
WAP	Orange	As per Drawing	Workstation
Data	Blue	As per Drawing	Both ends

- 2.1.6. Outlets shall be suitable for installation in faceplates at work station locations, surface raceway, or surface mount boxes.
- 2.2. WORKSTATION OUTLETS
- 2.2.1. Modular Furniture Faceplate
- 2.2.2. All furniture outlets that have a modular furniture knockout shall utilise 3 or 4-port modular furniture faceplate adapters. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.
- 2.2.3. Use recessed blanks for all unused ports. Blanks must match the frame colour.
- 2.2.4. Communications Contractor shall verify furniture manufacturer prior to ordering.
- 2.2.5. Provide a ½" spacer/adaptor, if required, to ensure faceplate can be properly installed on systems furniture maintaining proper bend radius
- 2.3. WALL FACEPLATE
- 2.3.1. Frames shall be 4 or 6-port frame (non-decora).
- 2.3.2. Faceplate color and type (decora/modular style) shall match electrical. Visible mounting screws to match the finish of their faceplate.
- 2.3.3. Use recessed blanks for all unused ports. Blanks must match frame colour.
- 2.3.4. Some locations on the floor plans may indicate a wall mount telephone. The contractor shall provide a wall mount faceplate suitable for wall mounting a telephone set in these locations.
- 2.3.5. Communications Contractor shall provide all faceplates for wall boxes designated Communications use that are not ganged with electrical outlet boxes.
- 2.4. DECORA ADAPTERS
- 2.4.1. Where wall boxes for the Communications Contractor use are ganged with electrical outlet boxes, floor or raceway outlets shall utilise 3 or 4-port Decora style adapters/inserts. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.
- 2.4.2. The Communications Contractor shall provide all Communications workstation adapters/inserts for all Communications outlets (ganged or single) when decora style faceplates are utilized. The Communications Contractor shall provide decora style faceplates for all Communications wall box locations where not ganged with Electrical.
- 2.5. SURFACE MOUNT BOXES
- 2.5.1. 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.
- 2.6. FLOOR MONUMENT
- 2.6.1. Floor monuments and faceplates shall be provided by Division 26 (Electrical). Refer to Division 26 Specifications and Drawings for further information
- 2.6.2. Communications Contractor shall determine type of module required to suit floor monument (i.e. MDVO, Keystone, etc.)
- 2.6.3. Where applicable, use recessed blanks for all unused ports. Blanks to match faceplate colour.

2.7. COVER PLATES AND DECORA STYLE BLANKS

2.7.1. The Communications Contractor shall supply and install a total of 20 blank Insert Plates and Cover Plates for wall / floor outlets.

2.8. BLANK INSERTS

2.8.1. All unused Communications ports must be installed with Blank Inserts. For Copper Patch Panels, use Black. For workstation outlets match existing/electrical.

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. Provide Blank Filler Plates for all unused modular jack positions on faceplates.

3.1.3. 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. Modular Furniture Faceplate

3.2.2. 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. Wall 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 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

3.2.4. 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

3.2.5. 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

- 3.2.6. The Communications Contractor must verify, with the Communications Engineer's Representative, the position of jacks prior to installation.

END OF SECTION

27 16 19.00 Communications 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 COMMUNICATIONS SECTIONS.

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

1.2. COPPER PATCH CORDS

1.2.1. All Data Patch Cords shall be connected in the Telecom Room to the Client supplied active equipment using 8 position 4 pair T568A/B: T568A/B Patch Cords.

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

2. Products

2.1. DATA PATCH CORDS AND PIGTAIL ASSEMBLIES

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

2.1.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the diameter grade and manufacturer of the Data Cable that is being warranted.

2.1.3. Patch cords to have stranded copper conductors (where system dictates) and designed to provide a mated-connection performance that exceeds the requirements per ANSI/TIA/EIA-568-D.

2.1.4. Patch cords and pigtail assemblies to be factory assembled and not site prepared, complete with snag less boot.

2.1.5. Patch Cord / Pigtail requirements:

Designation	Termination	Colour	Length	Location
Data	RJ45/RJ45	Blue	7' (ft) 2.13m	Telecom. Room
Data	RJ45/RJ45	Blue	10' (ft) 3m	Workstation
WAP	RJ45/RJ45	Orange	7' (ft) 2.13m	Telecom. Room
WAP	RJ45/RJ45	White	10' (ft) 3m	Workstation

3. Execution

3.1. UTP COPPER PATCH CORDS

- 3.1.1. 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 supplied and installed must maintain the Channel Solution.
- 3.1.2. 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