1. General

1.1. WORK INCLUDED

1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

1.1.2. Read and comply with all sections of this document.

1.1.3. Read and complete the Communications Tender and Supplementary Tender forms. This includes Division 1 and Division 26 for coordination

1.1.4. The Specification is divided into Sections which are not intended to identify contractual limits between Sub-Contractors nor between the Contractor and his Sub-Contractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.

1.1.5. Provide Communications components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

1.1.6. 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. SECTIONS AFFECTED

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

1.3. SCOPE OF WORK

1.3.1. This document is the Specification for the supply and installation of a Communications System for the following project:

Tomlinson Group

Ottawa, Ontario

1.3.2. This project consists of the supply and installation of horizontal UTP cabling to support Voice and Data applications for workstations, offices and meeting rooms throughout the premises. There is also a requirement for multipair copper and optical fibre backbone. Note: This project may also require cabling to be done for Audio Visual, Sound Masking portions of Division 27 and Division 28 Security. This is to be determined post tender awarding and is not to be factored into pricing. This is subject to a CCN.

1.3.3. The cabling shall be installed based on the drawing documents provided herewith.

1.3.4. Conduit and cable tray shall be supplied and installed by Division 26 as indicated on Division 26 drawings, unless otherwise noted.

1.3.5. The Cabling Contractor shall supply and install a complete Structured Cabling Solution 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. The Cabling Contractor shall include all communication outlets, terminating hardware and selected connectivity devices as outlined in this Specification.

1.3.6. The scope of work shall include but shall not be limited to:

.1 Supply and installation of cables and J-hooks required to support all cabling. Co-ordinate on site for interferences and with other disciplines / trades. All cable supports shall be installed following building lines, and in accordance with the building's requirements / guidelines.

.2 Supply and installation of 4-pair UTP cabling and associated accessories (jacks, furniture adapters, decora straps, modular copper patch panels, patch cords, etc.) to support end-user Data applications.

.3 Supply and installation of 4-pair UTP cabling and associated accessories (jacks, furniture adapters, decora straps, IDC punch down blocks, cross-connect wire, etc.) to support end-user Voice applications.

.4 Supply and installation of optical fibre cabling and associated accessories (connectors, optical fibre patch panels, patch cords, etc.) to support Data applications over backbone.

.5 Supply and installation of innerduct for optical fibre cabling.

.6 Supply and installation of multipair copper cabling and associated accessories (IDC punch down blocks, cross-connect wire, etc.) to support Voice applications over backbone.

.7 Supply and installation of cabinets, complete with all accessories (vertical cable managers, rails, horizontal cable managers, power bars, shelves, etc.).

.8 For copper cables, Cabling Contractor shall leave a 10-foot slack of cabling in the ceiling space above each workstation / work-area outlet.

.9 For copper and optical fibre backbone cables, Cabling Contractor shall leave a 10-foot slack of cabling in the ladder tray or on j-hooks above the ceiling (where applicable) above the racks/cabinets within the telecommunications room.

.10 For optical fibre cables, Cabling Contractor shall leave a minimum of 3.3 ft. of cabling coiled within the fibre patch panel.

.11 Communications Contractor to add data communication cable for Wireless Access Points. The location to be determined during construction. The maximum length of horizontal cable shall be ninety meters. The cable quantities are as follows:

.12 The Cabling Contractor shall assume that the entire installation will be done during regular hours, except: As per GC requirements and cut over period.

.13 Cabling Contractor shall provide to the Communications Consultant one bound hard copy of shop drawings / engineering specifications for all products prior to purchase to acquire written approval from the Client and / or the Communications Consultant.

1.3.7. While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and that the part numbers identified are correct, it is the responsibility of the Cabling Contractor to verify all part numbers and to report any errors and/or omissions in this Specification with their bid submissions.

1.3.8. Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurements.

1.3.9. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.

1.3.10. 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.

1.4. INTENT

1.4.1. Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.

1.4.2. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.

1.4.3. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and part of equipment and repair related damages.

1.5. BIDDER INQUIRIES

1.5.1. Bidders who find discrepancies or omissions in this Specification and accompanying drawings, or who have any doubt as to the technical meaning or intent of any part of this Specification and accompanying drawings, shall direct their questions or other inquiries in writing to TAL-CO.

1.5.2. In fairness to all bidders, all questions will be answered and distributed to all. Oral questions will not be answered. **No questions will be answered within 24 hours of the closing date / hour of the bid.**

1.6. TENDER FORM AND SUBMISSION OF TENDERS

1.6.1. 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.

1.6.2. Show separate, identified, alternate and unit prices for optional components or items called for as additions to or deductions from the Tender amount. Lump sum bids will not be accepted.

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

1.6.4. 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.

1.7. HOLDBACK

1.7.1. The value for testing and documentation (cable test results and as-builts), for payment purposes, shall be set at 10% of the base contract or $5,000; which ever is greater. This amount will be withheld from the Cabling Contractor until testing and correction of deficiencies is 100% complete.

1.8. SCHEDULE

1.8.1. The milestone(s) for the schedule in this project are as indicated below. The Cabling Contractor shall meet all indicated dates; however, they are subject to change. The Cabling Contractor shall verify with the Project Manager and/or General Contractor with the Construction Phase and the Cut-Over dates.

1.9. LABOUR

1.9.1. The Cabling Contractor must comply with all job-site requirements for the duration of the project.

1.9.2. The Cabling Contractor shall not assign or sub-contract any work without the prior **written consent** of the Project Manager. A list of sub-Contractors shall be submitted with the Tender response.

1.9.3. The Cabling Contractor agrees to use only tradesmen who are fully trained, qualified and experienced on the installation, termination and testing of the Structured Cabling Solution. The Cabling Contractor must be a certified Panduit installer.

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 represents a close approximation to the intent and requirements of the contract. The right is reserved by the Communications Consultant 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 Cabling 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.

1.10.7. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.10.8. Where equipment is shown to be 'roughed in only' obtain accurate information from the Communications Consultant before proceeding with the work.

1.10.9. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers and all other equipment shown on drawings (if shown) is diagrammatic.

1.10.10. The Cabling Contractor, at his expense, shall remedy any work not installed in correct location (at the sole discretion of the Communications Consultant). The Cabling Contractor is responsible to mark-out his work and fully co-ordinate with all other trades. Review with Communications Consultant prior to rough in. Prepare dimensioned layouts of each room prior to rough in for review by Communications Consultant. Do not proceed with any work until the Communications Consultant has reviewed and approved the layout drawings.

1.11. SUBSTITUTIONS

1.11.1. Proposed substitutions in order to be assessed 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 jurisdictional authorities;

.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 Reasons for the request.

1.11.2. The Communications Consultant'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 substitution will not be allowed.

1.12. BID FORM AND SUBMISSIONS OF BIDS

1.12.1. 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.

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

1.12.3. Where only one name (manufacturer) appears in the specification, the Bid shall include for the specified equipment / part.

1.12.4. 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.

1.12.5. The Owner reserves the right to accept or reject any substitution without question.

1.13. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

1.13.1. Materials and equipment supplied by this Division shall be new and free from defects.

1.13.2. All equipment and material for which there is a listing service shall bear a UL/ULC and/or CSA label.

1.13.3. Equipment shall meet all applicable FCC/CRTC Regulations.

1.13.4. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

1.14. CO-OPERATION WITH OTHER DIVISIONS

1.14.1. Communications cabling shall not touch or be supported from piping, ductwork, conduits, ceiling supports or any other structure / equipment. Communications cabling shall be supported by j-hooks, cable slings (CAT. 425), ladder tray (where provided) or shall be installed within conduit (where provided).

1.14.2. Supply all items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.

1.15. EXISTING SERVICES AND EQUIPMENT

1.15.1. All changes and connections to existing services shall be made only in a manner and at a time approved by the Communications Consultant and/or the Client so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, at no extra cost to the Contract.

1.15.2. Where connections are made to existing services, existing fire stopping shall be made good under this Division.

1.16. STATEMENT OF PRICES

1.16.1. To form a basis for progress payments the Cabling Contractor shall submit a statement of his 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.

1.17. METRIC CONVERSIONS

1.17.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, material and site services in both new and existing installations.

1.17.2. Conform to the Canadian Metric Practice Guide CSA-CAN3-2234-1-89.

1.18. ALTERNATIVE, SEPARATE AND IDENTIFIED PRICES

1.18.1. Several alternate, separate, identified and unit prices have been requested. These shall be completed on the Communications Supplementary Tender Form. Prices not on the Communications Supplementary Tender Form will not be accepted after the fact. Refer to the specific sections of the specifications and to the Drawings for details.

1.19. SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

1.19.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.

1.19.2. Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Conditions and conform to all requirements.

1.19.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. There shall be no smoking, and the site shall be kept clean at all times.

1.20. CUTTING, PATCHING AND REPAIRING

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

1.21. HOISTING FACILITIES

1.21.1. This Division shall provide its own hoisting facilities.

1.21.2. Hoisting facilities provided by the General Contractor may be available for subcontractors' use at no cost (verify with General Contractor prior to bid, or assume that no hoisting facilities are provided). If hoist facilities are inadequate, then Communications Contractor shall provide as required. Communications Contractor shall inform General Contractor(s) of requirements before tender closing date.

2. Products

2.1. STRUCTURED CABLING SOLUTION

2.1.1. The Cabling Contractor shall supply and install a complete end to end Structured Cabling Solution where the entire Channel is **manufactured, warranted and certified by a single manufacturer**. The Cabling Contractor shall be currently authorized and certified to install and warranty the Solution. If a sub-Contractor is being used for the installation, it is mandatory that the sub-Contractor be currently authorised and certified to install and warranty the Solution.

3. Execution

3.1. TERMINATION REQUIREMENTS

3.1.1. All cabling must be terminated using EIA/TIA 568A configuration, unless noted otherwise.

3.2. SITE EXAMINATION

3.2.1. Prior to submitting their Tender, the Cabling Contractor shall perform a site survey to become familiar 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 05.10

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.
Cabling Contractor	-	The successful bidder to this Specification responsible for the supply and installation of the Structured Cabling Solution.
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.
Client	-	Tomlinson Group
Communications Consultant	-	Gregory Frechette NOOGA Consulting Inc.
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 and Data 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
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
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
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
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
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)
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	-	Kilovolt ampere

kW	-	Kilowatt
kWh	-	Kilowatt hour
LAN	-	Local Area Network
laser	-	Light Amplification by Stimulated Emission of Radiation
lb	-	Pound
LED	-	Light Emitting Diode
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
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
TP	-	Twisted Pair
TR	-	Telecommunications Room
TS	-	Technical Standard
TSB	-	Telecommunications Systems Bulletin (formerly Technical Systems Bulletin)
TTY	-	Teletypewriter / Text Telehone
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 05.20

1. General

1.1. CODES, STANDARDS AND REGULATIONS COMPLIANCES

1.1.1. The Cabling Contractor shall adhere to all Codes, Standards, Regulations and documents listed throughout this document.

1.1.2. All products installed must meet or exceed all Local, Provincial and Federal Building, Fire, Health, Safety and Electrical Codes.

1.1.3. Non-plenum and plenum rated cables shall be ETL or ULC (UL) Listed and CSA Certified as type CMR / CMP (respectively), in accordance with the Binational Standard for Communications Cable, UL444/C22.2 No. 214-94.

1.1.4. 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 the table below. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.

STANDARD	TITLE
ANSI/ICEA	
S-80-576	Communication Cables.
S-83-596-1988	Optical Fibre Premises Distribution Cable.
S-83-640-1992	Optical Fibre Outside Plant Communications Cable.
Z136.2	American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources.
ANSI/TIA/EIA	
455	Optical Fibre Test Procedures.
TIA-492AAAA-A-2002	Detail Specification for 62.5um Core Diameter/125um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
TIA-492AAAB-2002	Detail Specification for 50 um Core Diameter/125um Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibers.
TIA-492AAAC-2003	Detail Specification for 850nm Laser Optimized, 50um Core Diameter/125um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
TIA-492CAAA-2002	Detail Specification for class IVa Dispersion-Unshifted Single Mode Optical Fibers.
ANSI/TIA 568-C.0	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA 568-C.1	Commercial Building Telecommunications Cabling Standard.
ANSI/TIA 568-C.2	Balanced Twisted Pair Telecommunications Cabling and Components Standard
ANSI/TIA 568-C.3	Optical Fiber Cabling Components Standard
TIA 569	Commercial Building Standard for Telecommunications Pathways and Spaces
604-3	Optical Fibre Connector Intermateability Standard (Focis 3).
ANSI/TIA 606-A	Administration Standard for Commercial Telecommunications Infrastructure
607-B	Telecommunications Grounding (Earthing) and Bonding for Customer Premises
758-A	Customer –Owned Outside Plant Telecommunications Infrastructure Standard
942	Telecommunications Infrastructure Standard for Data Centres
CSA	
C22.1-12	Canadian Electric Code Part I: Safety Standards for Electrical Installations.
C22.1 No. 181.4-M90	Plugs, Receptacles, and Connectors for Communication Systems.

C22.1 No. 214-94	Communications Cables.
C22.1 No. 0-M91	Canadian Electric Code Part II: General Requirements (Communications Cables).
C22.1 232 M1998	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-M90	Building Facilities, Design Guidelines for Telecommunications.
OTHER	
CAN/ULC S115	Standard Method of Fire Tests of Firestop Systems.
CAN/ULC S101	Standard Method of Fire Endurance Tests of Building Construction and Materials.
CAN/ULC S102	Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies.
CEC, Part 1	The Canadian Electrical Code, Part 1.
CENELEC EN 50173	Performance Requirements for Generic Cabling Schemes.
FIPS PUB 174	Commercial Building Telecommunications Wiring Standard. Federal Information Publication Standard.
ICEA S-90-661	Individually Unshielded Twisted Pair Indoor Cable for Use in Communications Wiring Systems.
IEEE Std 1100	IEEE Recommended Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book.
IEC 603-7, Part 7	Detailed Specifications for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Schemes.
ISO/IEC IS 11801A	Generic Cabling for Customer Premises.
NEMA WC 63	Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System.
OESC	Ontario Electrical Safety Code - 23rd Edition/2002.
OHSA	Occupational Health and Safety Act - R.S.O. 1990, c. 0-1.
O.R. 388/97	Ontario Fire Code.
O.R. 403/97	Ontario Building Code 1997.
UL 444 and 13	Adopted Test and Follow-Up Service Requirements For The Optional Qualification of 100Ω Twisted-Pair.
NCTA	National Cable Television Association.
NCTA-02/89 rev. 93	NCTA Recommended Practices for Measurements on Cable Television Systems.

1.1.5. Comply with the Ontario Electrical Safety Code, all Local, Provincial and Federal laws, where applicable and with requirements of the Canadian Standards Association (CSA) when mandatory. Make any changes or alterations required by the authorised inspector of the authority having jurisdiction, at no extra charge to the Client.

2. Products

2.1. NOT USED

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 Consultant will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Cabling Contractor's expense. The Cabling Contractor shall co-ordinate with the Communications Consultant prior to termination in any Telecom Room.

3.1.2. The maximum horizontal run length shall not exceed 90-metres. If the 90-metre constraint cannot be met, the Cabling Contractor shall notify the Communications Consultant of any cables that exceed 90-metres, prior to their installation.

END OF SECTION 27 00 05.30

1. General

1.1. WORK INCLUDED

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

1.2. SUBMITTALS - DRAWING DOCUMENTATION AND CABLE TEST RESULTS

1.2.1. The Cabling Contractor shall be provided with drawing(s) for construction on which the Cabling 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 Consultant shall have the right to inspect the status of the as-built drawing(s) from time to time during the construction process. On completion of the project, the Cabling Contractor shall forward to the Communications Contractor two sets of drawings indicating all such changes and deviations for review within 5 business days of the completion of the project.

1.2.2. The Cabling Contractor shall supply (temporary hand-marked) as-built drawings to Communications Consultant for Client use 3 days prior to cut-over.

1.2.3. The Cabling Contractor shall request (via email) from the Communications Consultant soft copy of drawings for use by the Cabling Contractor in preparation for record (as-built) drawings.

1.2.4. All changes to drawing(s) shall be Engineering Draft Standards. All Voice, Data and Coaxial outlet locations shall be identified with proper designation.

1.2.5. The Cabling Contractor shall return record drawing(s) on CD(s) using AutoCAD 2009 or later release. If the Cabling Contractor cannot comply with this requirement, NOOGA will update all hand drawn as-builts to AutoCAD. The cost for this service shall be based on an hourly rate at time of completion. The Cabling Contractor shall be responsible for the costs associated with this work.

1.2.6. The Cabling 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 TAL-CO for final review and delivery to the Client.

1.2.7. The Cabling 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 Cabling Contractor must sign the entire report. The Cabling Contractor shall forward 1 hard copy in a white 3 D-ring binder to TAL-CO's office within 5 business days of the completion of the project. The hard copy shall be provided in a one page per cable/strand test format. The Cabling 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).

1.2.8. The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) and cable test results are provided.

1.3. SUBMITTALS - TESTING AND COMMISSIONING

1.3.1. Provide testing and commissioning documentation for all items and their related components to the Communications Consultant prior to the completion of the project or at the Communications Consultants request. Include maintenance manuals and operating instructions for Client's staff use.

1.4. PERMITS, LICENSE INSPECTIONS AND FEES

1.4.1. Where materials are specified which require special inspection and approval of CSA and/or local authorities obtain such approval for the particular installation with the co-operation of the material supplier. Obtain and pay for permits and inspection required for work performed.

1.4.2. 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.

1.5. ALTERNATE PRODUCT

1.5.1. 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.**

1.5.2. Where supply of the materials would compromise the schedule, the Cabling Contractor shall be required to submit a request to use alternate product to the Communications Consultant. Depending on the circumstance, the Communications Consultant may provide written authorisation to substitute the Product. Written authorisation shall be obtained before alternatives are purchased or installed.

1.6. SCHEDULING

1.6.1. Within one week of award of the contract submit a formal project schedule to the Communications Consultant 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.

1.6.2. Updated schedules shall be submitted as periodically requested by Communications Consultant.

1.7. CLEANUP

1.7.1. The Cabling 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 Cabling Contractor.

1.7.2. Upon completion of the work and before acceptance and final payment will be made, the Cabling 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.

1.8. ACCEPTANCE

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

1.9. INSPECTION AND TESTING REQUIREMENTS

1.9.1. The Communications Consultant must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.

1.9.2. The Communications Consultant 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 Cabling Contractor the Communications Consultant may ask the Cabling Contractor to perform a random test of up to 10% of the links. The Cabling 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 Cabling Contractor under supervision of the Communications Consultant 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 Consultant shall be borne by the Cabling Contractor.

1.10. SUBMITTALS - CONNECTIVITY DATABASE

1.10.1. The Cabling Contractor shall prepare separate Data and Voice Connectivity Databases in Microsoft Excel spreadsheet format that includes the following:

.1 Data - For data connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Data cable number, active equipment port and copper and/or fibre backbone cable/strand.

.2 Voice (Centrex) - For voice connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Voice cable number, backbone pair, service provider demarcation pair(s), DID and LEN.

.3 Voice (PBX) - For voice connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Voice cable number, backbone pair and Telephone Switch/Node TN.

1.10.2. One hard copy and one soft copy shall be supplied to the Communications Consultant.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION 27 00 05.60

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

1.2.1. The Cabling Contractor shall assume that the entire cable installation will be done during regular hours, except:

.1 as noted in Section 27 00 05.10 of this specification;

.2 as outlined in the project schedule.

1.3. FLOOR/CEILING TILES

1.3.1. The Cabling 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 Cabling Contractor shall remove and re-install the tiles after their work is complete.

1.3.2. Any damage to ceiling tiles during the installation of any work described in this document shall be the responsibility of the Cabling Contractor. Damages include chipping, breaking or fingerprints. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Project Manager and/or the Communications Consultant.

1.3.3. The Cabling Contractor shall be responsible for storage and protection of floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.4. CUT OVER PLANNING AND MANAGEMENT

1.4.1. The Cabling Contractor shall allow for 1 technician for 8 regular hours to be on site for cut over support for each phase. 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.

1.4.2. The Cabling Contractor shall schedule their installers such that the cut over schedule is maintained. Any shift work or overtime that is required to complete the project on schedule shall be included in the Cabling Contractor's Tender bid.

1.5. SAFETY OF PERSONS AND PROPERTY

1.5.1. The Cabling Contractor shall comply with all laws, ordinances, rules, regulations, 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.

1.5.2. 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.

1.5.3. 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.

1.5.4. No open flames/smoking shall be permitted without prior written approval of the Client.

1.5.5. The Cabling 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 Cabling Contractor.

1.6. ACCESS TO SITE

1.6.1. The Cabling Contractor shall be responsible for coordinating site access with the General Contractor and/or Client as determined during the initial project meeting.

1.7. IDENTIFICATION

1.7.1. All Cabling Contractor personnel shall be clearly identified by either uniform or company ID. In addition, the Cabling Contractor may be required to wear Client provided ID for required card access locations or identification. All Client ID must be returned daily or at the end of the project as determined by the Client.

1.8. EMERGENCY FACILITIES

1.8.1. The Cabling 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.

1.9. PRODUCT DELIVERY REQUIREMENTS

1.9.1. The Cabling Contractor shall be responsible for complete delivery, handling, and installation of all materials used in the performance of the work.

1.9.2. 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.

1.10. PRODUCT AND TOOLS STORAGE REQUIREMENTS

1.10.1. The Cabling Contractor shall be responsible for complete storage and handling of all materials used in the performance of the work.

1.10.2. The Cabling 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 Cabling Contractor. The Client and his representative shall be in no way responsible or liable for any tools of the Cabling Contractor.

1.11. CONFINED SPACES

1.11.1. The Cabling Contractor shall comply with all code related and Client specific safety requirements, if work is to be performed in a confined space.

1.12. CO-ORDINATION WITH OCCUPANTS

1.12.1. The Cabling Contractor shall be responsible for co-ordinating all work with the Client/tenant of the floor space for their daily work.

1.13. PROJECT MEETINGS

1.13.1. The Cabling Contractor shall attend site meetings when requested by the Communications Consultant and/or the Project Manager. Regular meetings may occur once per week at the Communications Consultant's and/or the Project Manager's discretion.

1.13.2. The Cabling 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.

1.13.3. PROGRESS REPORTS

1.13.4. The Cabling 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 USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. The Cabling 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 Cabling 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 Cabling 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 05.70

1. General

1.1. WORK INCLUDED

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

1.2. GENERAL

1.2.1. 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.

1.3. MANUFACTURERS

1.3.1. Products manufactured by Specified Technologies Inc. (or approved equivalent) are acceptable.

1.3.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.

1.4. FIRE STOPPING

1.4.1. Provide seals in all Fire Rated Separations and Firewalls to form tight barriers to retard the passage of flame and smoke.

1.4.2. 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.

1.4.3. 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.

1.4.4. The Cabling Contractor shall establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed, or were created by others for use by the Cabling Contractor.

1.4.5. Supply and install Fire Stop pillows for existing cable tray penetrations through firewalls.

1.4.6. 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.

1.4.7. 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).

1.4.8. All fire stopping shall maintain a minimum one-hour rating and shall meet applicable Federal, Provincial and Local building codes.

1.4.9. All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the Standards.

1.4.10. Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.

1.4.11. All Smoke Seals selected for use shall comply with Standards.

1.4.12. 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.

1.4.13. 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.

1.5. WATER PROOFING

1.5.1. The Cabling 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.

1.5.2. All service entrance conduits through building shall be sealed or resealed upon cable placement. Spare conduits shall be plugged with expandable plugs.

1.6. QUALITY ASSURANCE

1.6.1. Provide fire stopping systems that comply with the following requirements:

.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.

1.6.2. 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.

1.6.3. Fire Stop Systems shall conform to the fire (F), hose (H) and temperature (T) ratings of Codes.

1.6.4. Fire Stop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").

1.6.5. For the purposes of this specification the only acceptable Fire Stop Systems are those that have been tested to the CAN/ULC S115 Standard.

1.7. PERFORMANCE

1.7.1. 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.

1.7.2. 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.

1.7.3. 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.

1.7.4. Openings for cable trays shall be sealed using re-enterable fire stopping pillows.

1.8. PROJECT CONDITIONS

1.8.1. Do not install fire stopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

1.8.2. Do not install fire stopping products when substrates are wet due to rain, frost, condensation, or other causes.

1.8.3. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

1.8.4. Do not use materials that contain flammable solvents.

1.8.5. Coordinate construction of openings and penetrating items to ensure that through-penetration fire stop systems are installed according to specified requirements.

1.8.6. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

1.8.7. Schedule installation of fire stopping after completion of penetrating item installation but prior to covering or concealing of openings.

2. Products

2.1. FIRE STOP SEALANTS

2.1.1. Firestop Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture. The following products are acceptable:

.1 Specified Technologies Inc. (STI) SpecSeal® Series SSS Sealant;

.2 Specified Technologies Inc. (STI) SpecSeal® Series LCI Sealant.

2.2. FIRE STOP PUTTY

2.2.1. Firestop Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds. The following products are acceptable:

.1 Specified Technologies Inc. (STI) SpecSeal® Series SSP Putty.

2.3. FIRE STOP PILLOWS

2.3.1. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag. The following products are acceptable:

.1 Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows.

2.4. FIRE RATED CABLE PATHWAYS

2.4.1. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. The following products are acceptable:

.1 Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.

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 Cabling Contractor shall be required to 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 Project Manager. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION 27 00 06.00

Part 1 General

1.1 WORK INCLUDED

.1 Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2 DESCRIPTION OF SYSTEM

.1 Provide a raceway system complete with cable trays, conduits, junction boxes and back boxes for this communication system. All communications wiring is to be run through conduit. Free air communications cabling is not acceptable. A complete communication system shall be supplied and installed by others.

.2 Provide pull strings in every run of conduit.

.3 Minimum size conduit to be ¾ inch EMT.

Part 2 Products

2.1 COMMUNICATION SYSTEM

.1 The communication system will be tendered by Division 27.

Part 3 Execution

3.1 INSTALLATION

.1 Install a cable tray and conduit raceway system complete with junction boxes and back boxes.

.2 Color code all junction boxes and conduits according to section 26 05 53.00 – Identification.

END OF SECTION 27 05 00.00

1. General

1.1. WORK INCLUDED

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

1.1.2. This document describes the products and execution requirements relating to supplying and installing Grounding and Bonding for Communications Systems.

1.1.3. This section includes minimum requirements for the following:

.1 Grounding System;

.2 Telecommunications Grounding Busbar (TGB);

.3 Telecommunications Main Grounding Busbar (TMGB);

.4 Telecommunications Bonding Backbone (TBB);

.5 Rack Grounding and Bonding;

.6 Cabinet Grounding and Bonding.

1.1.4. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labelled, and documented by the Communications Contractor as detailed in this document.

1.1.5. Product specifications, general design considerations, and installation guidelines are provided in this document.

1.1.6. The Communications Contractor shall meet or exceed all requirements for the grounding system described in this document.

1.2. GENERAL REQUIREMENTS

1.2.1. Local electrical codes shall be adhered to.

1.2.2. The grounding system shall comply with ANSI/TIA-942 and J-STD-607-A.

1.2.3. The grounding system shall create a low impedance path to earth ground for electrical surges and transient voltages.

1.2.4. The grounding system shall be intentional, visually verifiable, adequately sized to handle expected currents safely, and direct these potentially damaging currents away from sensitive network equipment. As such, the grounding shall be purposeful in its design and installation.

1.2.5. All grounding conductors shall be copper.

1.2.6. Lugs, HTAPs, grounding strips, and busbars shall be UL Listed and made of premium quality tin-plated electrolytic copper that provides low electrical resistance while inhibiting corrosion. Antioxidant shall be used when making bonding connections in the field.

1.2.7. Wherever possible, two-hole lugs shall be used because they resist loosening when twisted (bumped) or exposed to vibration. All lugs shall be irreversible compression and meet NEBS Level 3 as tested by Telcordia. Lugs with inspection windows shall be used in all non-corrosive environments so that connections may be inspected for full conductor insertion (battery rooms are an exception where windowless lugs may be used).

1.2.8. Die index numbers shall be embossed on all compression connections to allow crimp inspection.

1.2.9. Cable assemblies shall be UL Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.

1.2.10. Electrical continuity throughout each rack or cabinet is required to minimize safety risks. The Cabling Contractor shall supply and install all necessary hardware to ensure that each part of each rack and each cabinet is grounded.

1.2.11. Any metallic component that is part of a Telecommunications Room, LAN Room, Entrance Facility, Computer Room, Data Centre (etc.), including equipment, racks, cabinets, ladder racks, enclosures, cable trays, duct work, etc. shall be bonded to the grounding system.

1.3. TELECOMMUNICATIONS BONDING BACKBONE REQUIREMENTS

1.3.1. The Telecommunications Grounding Busbar (TGB) in each telecommunications space shall be grounded to the Building Ground Riser by Division 16/26. The TGB and its Telecommunications Bonding Backbone (TBB) shall be supplied and installed by Division 16/26.

1.3.2. The gauge of the connecting ground cable, known as the Telecommunications Bonding Backbone (TBB) will follow J-STD-607-A guidelines, as is shown in the table below.

Sizing of the TBB (by Division 16/26)	
TBB Length in Linear metres (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
Greater than 20 (66)	3/0

1.3.3. In telecommunications spaces with only one rack or cabinet, the grounding jumper cable can be connected directly to the TGB

2. Products

2.1. EQUIVALENT PRODUCTS

2.1.1. All grounding and bonding products required to meet the requirements of this section and the applicable codes and standards shall be manufactured by Panduit or approved manufacturer.

2.1.2. PANDUIT STRUCTUREDGROUND™ Grounding System kits or approved equivalent product, components, and hardware shall be used to construct the grounding system.

2.2. TELECOMMUNICATIONS GROUNDING BUSBAR

2.2.1. The Telecommunications Grounding Busbar (TGB) shall be supplied and installed by Division 16/26. The Communications Contractor shall use Panduit LCC-W series lugs or approved equivalent product when connecting conductors to the TGB.

2.3. COMMON BONDING NETWORK

2.3.1. The Cabling Contractor shall supply and install a #2 AWG Common Bonding Conductor within each Telecommunications Room, LAN Room, Entrance Facility, Computer Room, Data Centre (etc.) as shown on drawings. Where a Common Bonding Network is specified (refer to drawings), route the CBN to each TGB in as straight a path as possible. The CBN should be installed as a continuous conductor.

2.3.2. Avoid routing grounding conductors in metal conduits. If the grounding conductor must be routed through a metal conduit, bond each end of the conduit to the grounding conductor. Use *PANDUIT* GPL series grounding clamps or equivalent to bond to the conduit, a *PANDUIT* HTWC HTAP with clear cover or equivalent to bond to the grounding conductor, and a #6 AWG copper conductor to connect the GPL grounding clamp to the HTWC HTAP.

2.4. RACK GROUNDING

2.4.1. For every (two post) rack the Cabling Contractor shall supply and install all components as listed below to ensure electrical continuity of ground between all rack elements as well as installed equipment.

.1 For racks that are assembled with nuts and bolts, the Cabling Contractor shall supply and install Panduit paint piercing grounding washers, series RGW to provide electrical continuity between rack elements where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack (a total of 8 washers required per rack). Where a rack is supplied from factory assembled by way of welding all components, paint piercing grounding washers are not required.

.2 For racks using metal vertical cable managers, the Cabling Contractor shall supply and install Panduit paint piercing grounding washers, series RGW to provide electrical continuity between rack rails and vertical cable managers where they bolt together, on both sides, under the head of the bolt and between the nut and rack (2 washers are required for every set of bolt and nut).

.3 The Cabling Contractor shall supply and install one full-length rack ground strip per rack, Panduit series RGS, attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact.

.4 The Communications Contractor shall supply and install the appropriate Panduit RG series jumper for the equipment (such as network switches) being installed and the thread-forming screws provided in the kit.

.5 The Communications Contractor shall supply and install one common bonding network jumper, Panduit part number RGREJ696, to attach the rack ground strip to the Common Bonding Network (CBN), or directly to the Telecommunications Grounding Busbar (TGB) in the Telecommunications Room. Do **not** bond racks serially. Where a CBN is specified, use the copper compression HTAP that comes with the kit to bond the conductor to the CBN. Where a CBN is not specified, use a Code Conductor Two Hole Long Barrel with Window Lug – LCC6-14JAWH-L (not supplied with this kit) to bond the common bonding network jumper to the TGB

.6 The Communications Contractor shall supply and install four (4) bonding screws for every patch panel, every horizontal cable manager and every switch (assume 48 port switches, one port for every horizontal cable installed). Patch panels, horizontal cable managers and switches shall be bonded to racks using Panduit bonding screws. Supply and install bonding screws as required for the appropriate equipment mounting hole size.

.7 The Cabling Contractor shall supply and install one electrostatic discharge (ESD) port kit, Panduit series RGESD, directly to the rack grounding strip on the back of the rack at approximately 48 inches from the floor. The Cabling Contractor shall supply and install a second RGESD directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack. Place the ESD protection identification stickers directly above the ESD ports. ESD port installed in the front of the rack may be installed on top of a patch panel or horizontal cable manager

2.5. RETROFIT RACK GROUNDING

2.5.1. Where racks already have network equipment installed, the Cabling Contractor shall supply and install all components as listed below to ensure electrical continuity of ground between all rack elements as well as installed equipment, without removing any equipment or patch cords.

.1 For racks using metal vertical cable managers, the Cabling Contractor shall supply and install Panduit paint piercing grounding washers, series RGW to provide electrical continuity between rack rails and vertical cable managers where they bolt together, on both sides, under the head of the bolt and between the nut and rack (2 washers are required for every set of bolt and nut)

.2 The Cabling Contractor shall supply and install one rack grounding busbar per rack, Panduit part number RGRB19, attached to the rear of the rack straddling both side rails with the thread-forming screws provided to ensure metal-to-metal contact.

.3 The Communications Contractor shall supply and install the appropriate Panduit RG series jumper for the equipment (such as network switches) being installed and the thread-forming screws provided in the kit.

.4 The Communications Contractor shall supply and install one common bonding network jumper, Panduit part number RGREJ696, to attach the rack ground busbar to the Common Bonding Network (CBN), or directly to the Telecommunications Grounding Busbar (TGB) in the Telecommunications Room. Do **not** bond racks serially. Where a CBN is specified, the Communications Contractor shall supply and install a copper compression HTAP, Panduit part number HTWC250-2-1, to bond the conductor to the CBN. Where a CBN is not specified, the Communications Contractor shall supply and install a Code Conductor Two Hole Long Barrel with Window Lug, Panduit part number LCC6-14JAWH-L, to bond the common bonding network jumper to the TGB.

.5 The Communications Contractor shall supply and install four (4) bonding screws for every patch panel, every horizontal cable manager, every shelf and every switch (assume 48 port switches, one port for every horizontal cable installed). Patch panels, horizontal cable managers and switches shall be bonded to racks using Panduit bonding screws. Supply and install bonding screws as required for the appropriate equipment mounting hole size.

.6 The Cabling Contractor shall supply and install one electrostatic discharge (ESD) port kit, Panduit series RGESD, directly to the rack grounding strip on the back of the rack at approximately 48 inches from the floor. The Cabling Contractor shall supply and install a second RGESD directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack. Place the ESD protection identification stickers directly above the ESD ports. ESD port installed in the front of the rack may be installed on top of a patch panel or horizontal cable manager.

2.6. CABINET GROUNDING - #12-24 OR #10-32 EQUIPMENT HOLE RAILS

2.6.1. For every cabinet the Cabling Contractor shall supply and install all components as listed below to ensure electrical continuity of ground between all rack elements as well as installed equipment.

.1 The Cabling Contractor shall supply and install one full-length rack ground strip per equipment mounting rail (4 ground strips per cabinet), Panduit series RGS, attached to each rail with the thread-forming screws provided to ensure metal-to-metal contact.

2.7. TELECOMMUNICATIONS GROUNDING AND BONDING CONDUCTOR LABEL KIT

2.7.1. The Communications Contractor shall supply and install one Telecommunications Grounding and Bonding Conductor Label Kit for every rack and cabinet as well as one for every Telecommunications Grounding Busbar. Panduit part number LTYK or equal.

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. The Cabling 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 Cabling 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 Cabling 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 05 26.00

1. General

1.1. WORK INCLUDED

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

1.1.2. Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 26 – as shown on drawings) to distribute the cables throughout the facility. Where cables leave the pathways provided by Division 26, the Cabling Contractor shall supply and install cable slings and/or j-hooks to support cabling up to point of termination.

1.2. INDOOR CABLE DISTRIBUTION

1.2.1. Utilise all indicated and available cable pathways such as conduits, Communications cable tray, ducts, surface raceways (by Division 26) and furniture system channels except where otherwise noted.

1.2.2. Inside buildings minimise any possibilities of disruption by maintaining the following minimum clearances from electrical and heat sources when routing cables.

Item	Minimum Clearance
Motors	1.20 m (4'-0")
Transformers	1.20 m (4'-0")
Conduit and cables used for electrical distribution less than 1kVA	0.30 m (1'-0")
Conduit and cables used for electrical distribution greater than 1kVA	1.00 m (3'-0")
Fluorescent Luminaries	12 cm (0'-5")
Pipes (gas, oil, water, etc.)	30 cm (1'-0")
HVAC (equipment, ducts, etc.)	15 cm (0'-6")

2. Products

2.1. NON-CONTINUOUS CABLE SUPPORT

2.1.1. The Cabling Contractor shall supply and install cable support for the distribution of horizontal and backbone cables where conduit or ladder tray has not been provided. Cable supports shall be manufactured by Erico, or approved equal.

Description	Max # Cat.3/Cat.5e Cables	Max # Cat.6 Cables	Erico*
J-Hook	16	10	CAT12
J-Hook	50	32	CAT21
J-Hook	80	50	CAT32
J-Hook	300	185	CAT64
Adjustable Cable Support	425	256	CAT425
Vertical Backbone Support	(N/A)	(N/A)	CAT600

Notes: *Product Codes shown indicate only Series numbers and are not application specific.

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

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

2.1.4. The Cabling Contractor shall supply and install CAT425 supports for main cabling runs, regardless of quantity of cabling installed.

2.2. VELCRO TIE-WRAPS

2.2.1. The Cabling Contractor shall supply and install Velcro tie-wraps. Only Velcro tie-wraps shall be acceptable. Under no circumstance shall plastic tie-wraps be used.

Panduit
HLS/HLM-15R0 (Black)

2.2.2. If plastic tie-wraps are used the Cabling 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. Panduit part number: T50F-CX.

2.4. INNERDUCT

2.4.1. For plenum rated spaces, supply and install plenum rated Innerduct. Carlon part number: CF4X1C-500 (size to suit).

2.4.2. For riser rated spaces, supply and install riser rated Innerduct. Carlon part number: DF4X1C-500R (size to suit).

2.4.3. Where Innerduct is installed for use with multimode fibre, it shall be Orange. Where Innerduct is installed for use with single mode fibre, it shall be Yellow. All Innerduct shall be installed with pre-lubricated pull tape.

2.5. GROUNDING WIRE

2.5.1. Supply and install #6 AWG green grounding wire for all metallic components that shall be grounded.

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. 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 Cabling Contractor will be required to comb and redress any cables that are unsatisfactory at no additional cost.

3.2.2. Attaching to T-bar support rods is not acceptable. Anchors for hangers must not be drilled into post tensioned beams under any circumstances. The Cabling Contractor shall not use Hilti Pneumatic hammers. All anchors must be drilled into slab.

3.2.3. The Cabling 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. Maximum spacing of Velcro for horizontal cables into or along vertical cable managers shall be no more than 6", this includes cabling dropped from the ladder tray or ceiling above.

3.4. SPIRAL WRAP

3.4.1. Install Spiral Wrap from system furniture feed points to system furniture entry point. Spiral Wrap shall be butted so that no cables are exposed.

3.5. INNERDUCT

3.5.1. All Fibre Cables shall be installed in innerduct over their entire length inside the building to provide mechanical protection. The fibre cabling may be installed without innerduct under the following conditions:

.1 armoured Fibre cabling;

.2 where a dedicated fibre conduit is installed that is 1.5" in diameter or less.

3.5.2. Minimise the number of separate innerducts installed by pulling multiple fibre cables through each innerduct.

3.5.3. Innerduct shall be CMP (FT6) rated, as is appropriate for ceiling space classification. Innerduct shall be sized to suit installation requirements.

3.6. CABLE DISTRIBUTION

3.6.1. Ensure ANSI/EIA/TIA-568-C installation practices are followed for Indoor cable distribution and ANSI/EIA/TIA-758 installation practices are followed for Outdoor cable distribution.

3.6.2. Station personnel at each access point (i.e. Handhole, manhole, etc.) to observe and lubricate the cables being pulled. Submit tension pull calculation for installation of cables to Communications Consultant.

3.6.3. Do not exceed the copper/fibre cables maximum tensile rating during installation. Monitor tension of the cable during installation. Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension specifications during installation. 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 Consultant, to prevent over tension on the cable.

3.6.4. Minimum bend radius shall be as per manufacturer's recommendations.

3.6.5. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.

3.6.6. Protect exposed cable ends from moisture ingress.

3.6.7. Cable passing through manholes to have sufficient slack for expansion/contraction and shall be mounted with clips to prevent sagging.

3.7. DUCT AND CONDUIT

3.7.1. 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 Consultant of the problems encountered.

3.7.2. 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 28.00

1. General

1.1. WORK INCLUDED

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

1.1.2. Labelling schemes shall be confirmed with the Communications Consultant prior to installation.

1.2. HORIZONTAL CABLE LABELLING

1.2.1. The cable labelling for Horizontal Voice/Data cables and IDC Blocks / Patch Panels shall be as follows:

TX.Y where:

T indicates type of cable: Voice (V) or Data (D);
X indicates the floor;
Y indicates the Cable Number (numeric) 001… highest cable number

Example: D7.017

D indicates data;
7 indicates 7th floor;
017 indicates 17th Cable.

1.3. COPPER BACKBONE LABELLING

1.3.1. For each labelling strip for pairs on the IDC mount, provide labels showing the first and last pair for every wafer. On each label indicate the pair count and destination of the multipair cable.

1.3.2. The labelling for Copper Backbone cabling shall be as follows:

Pair 1		Pair 25
	XXX Pair To/From Address - YYth Floor, Room ZZZ	
Pair 26		Pair 50

where:

XXX indicates pair count of cable(s);
YY indicates the floor;
ZZZ Indicates room Number or Designation.

Note: Pair numbering shall be identified by the Client.

1.4. FIBRE BACKBONE LABELLING

1.4.1. The labelling for Fibre Backbone cabling shall be as follows:

Example:

XXX Strand To/From Address - YYth Floor, Room ZZZ

where:

XXX	optical fibre strand count of cable(s)
YY	indicates the floor;
ZZZ	Indicates room Number or Designation.

Note: Each strand shall be identified individually at the Fibre Connector.

2. Products

2.1. LABELLING

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

2.1.2. 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.

3. Execution

3.1. LABELLING

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

3.2. HORIZONTAL LABEL LOCATIONS

3.2.1. Labels should be attached to the front of the Workstation faceplate, one to the front of the distribution connector/IDC field, and one at each end of the cable (within 4” of end).

3.3. BACKBONE LABEL LOCATIONS

3.3.1. Labels should be attached to the front of the distribution connector/IDC field, and one at each end of the cable (within 4” of end).

END OF SECTION 27 05 53.00

1. General

1.1. WORK INCLUDED

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

1.1.2. 100% of the installed cabling links shall be tested and shall pass the requirements of the Standards as defined within this document. Any failing link shall 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.

1.1.3. All deficiencies shall be corrected before the Communications Consultant will provide a certificate to release the Holdback on the project.

1.1.4. The Cabling Contractor is required to submit test results as specified under Section 27 00 05.60 – ADMINISTRATIVE REQUIREMENTS.

1.1.5. Test patch cords to portable tester shall be designed for testing by the manufacturer. Field assembled patch cords shall not be acceptable. Field testers shall use the appropriate jack/tester adapter specified for use with the cabling jack(s) specified within this document.

1.1.6. The Cabling Contractor shall produce a test report based on the cable schedules. The report shall indicate for each cable, when it was tested successfully, location, cable type, cable number and tester make and model. A sample of the test report shall be submitted to the Communications Consultant for approval. The entire report shall be signed by an authorised person for the Cabling Contractor at the end of the project.

1.2. COPPER CABLING TEST REQUIREMENTS

1.2.1. 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-C.1.

1.2.2. The installed twisted-pair horizontal links shall be tested from the Telecom Room to the workstation against the “Permanent Link” performance limits Specification as defined in ANSI/TIA/EIA-568-C.1.

1.2.3. 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.

1.2.4. 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-C. The tester including the appropriate interface adapter shall meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in TIA/EIA-568-C.2.

1.2.5. The tester interface adapters shall 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 Cabling 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.

1.2.6. 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*.

1.2.7. 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.

1.3. COPPER CABLING PERFORMANCE TEST PARAMETERS

1.3.1. The test parameters for Cat 6 are defined in TIA Cat 6 Standard, which refers to TIA/EIA-568-C.2. 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) shall meet or exceed the limit value determined in the above- mentioned Standard.

1.3.2. 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.

1.3.3. 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 vendor in order to achieve the vendor-specified measurement accuracy.

1.4. OPTICAL FIBRE CABLING TEST REQUIREMENTS

1.4.1. Every optical fibre cabling link in the installation shall be tested in accordance with the field test Specifications defined by the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA- 568-C.3 (or by the appropriate network application Standard(s) whichever is more stringent).

1.4.2. ANSI/TIA/EIA-568-C.3, defines the passive cabling network, to include cable, connectors, and splices (if present), between two optical fibre patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect, or (3) intermediate cross-connect to horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

1.4.3. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. These certificates may have been issued by any of the following organisations or an equivalent organisation:

.1 the manufacturer of the optical fibre cable and/or the optical fibre connectors;

.2 the manufacturer of the test equipment used for the field certification;

.3 training organisations authorised by BICSI (Building Industry Consulting Services International) or by the ACP (Association of Cabling Professionals™);

.4 Vendor supplied certifications for their product.

1.4.4. Field test instruments for multimode fibre cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B; Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with a Category 1 light source. Field test instruments for singlemode fibre cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

1.4.5. The optical fibre launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

1.4.6. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests as detailed below.

1.4.7. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

1.5. OPTICAL FIBRE CABLING PERFORMANCE TEST PARAMETERS

1.5.1. ANSI/TIA/EIA Standard 568-C prescribes that the single performance parameter for field testing of optical fibre links is link attenuation when installing components compliant with this Standard.

1.5.2. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA 568-C:

Link Attenuation	Cable_Attn + Connector_Attn + Splice_Attn
Cable Attn (dB)	Attenuation_Coefficient (dB/km) x Length (Km)
Connector Attn (dB)	Number_of_connector_pairs x connector_loss (dB) (Maximum allowable connector_loss = 0.75 dB)
Splice_Attn (dB)	Number of splices (S) x splice_loss (dB) (Maximum allowable splice_loss = 0.3 dB)

1.5.3. The values for the Attenuation Coefficient are listed in the table below:

Type of optical fibre	Wavelength (nm)	Attenuation Coefficient (dB/km)
Mulimode 62.5/125µm	850	3.5
	1300	1.5
Multimode 50/125 µm	850	3.5
	1300	1.5
Singlemode (Inside Plant)	1310	1.0
	1550	1.0
Singlemode (Outside Plant)	1310	0.5
	1550	0.5

1.5.4. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

1.5.5. The above link test limits attenuation is based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these Standards or application notes to accurately conduct performance testing.

1.5.6. The Horizontal Link (multimode): acceptable link attenuation for a multimode horizontal optical fibre cabling Solution is based on the maximum 90 m (295 ft.) distance. The horizontal optical fibre cabling link segments need to be tested at only one (1) wavelength. Because of the short length of cabling [90 m (295 ft.) or less], attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm or 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, and One Reference Jumper. The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft.) of optical fibre cable.

1.5.7. The Backbone Link (multimode) shall be tested in one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.

1.5.8. Multimode Backbone Links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

1.5.9. Singlemode Backbone Links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, and One Reference Jumper. All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm (See Note below).

.1 Link attenuation has been based upon the use of a light source categorised by a Coupled Power Ratio (CPR) of Category 2, Underfilled, per Annex B of ANSI/EIA/TIA-526-14A. The use of a light source categorised as Category 1, Overfilled, may provide results higher than the 2.0 dB limit. A field test tool based on LED (light emitting diode) light sources is a Category 1 device and typically yields high attenuation results.

.2 Links destined to be used with network applications that use laser light sources (underfilled launch conditions) shall be tested with test equipment based on laser light sources. This rule should be followed for Cabling Solutions to support Gigabit Ethernet. Gigabit Ethernet only specifies laser light sources.

.3 For Gigabit Ethernet compliant certification (IEEE STD 802.3z application), use test equipment which uses a VCSEL (Vertical cavity surface emitting laser) at 850 nm (compliant with 1000BASE-SX) and a FP laser at 1310 nm (compliant with 1000BASE-LX).

1.5.10. Each optical fibre link terminated with an optical adapter system which does not impose a transmission direction because the adapters are not or cannot be ganged should be tested and documented in both directions since the direction of the signal transmission cannot be predicted at the time of installation.

1.5.11. Test each strand of fibre with an Optical Time Domain Reflectometer for length and attenuation. Performance test must be below the total return loss budget for the cable connectors/balun. Provide comprehensive optical time domain reflectometry (OTDR) testing for all fibre runs. Include a hard copy chart recording with the test documentation.

1.6. WARRANTY AND CERTIFICATION REQUIREMENTS

1.6.1. The Cabling Contractor is required to provide a **minimum of 25-year parts and labour Warranty** for the entire Certified Structured Cabling Solution, including both UTP copper and fibre.

1.6.2. Response time for Warranty items shall be 24 hours. The Cabling 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.

1.6.3. From the date of issuance of a “Certificate of Substantial Performance”, all equipment, materials and workmanship must be unconditionally Warranted for a period of one (1) year, or such longer periods as may be provided in the Warranty of the manufacturer of individual components, whichever is longer.

1.6.4. Provide a manufacturer Plaque and Warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer specifications. A frame certificate will be acceptable if a plaque is not available from the manufacturer.

1.6.5. Upon request and at no additional cost to the Client the Cabling Contractor must provide a manufacturer’s technical representative to conduct an on-site visit to ensure complete technical compliance.

1.6.6. All documentation including Plaque must be in English and French. The wording for the Plaque shall be submitted to the Communications Consultant 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, Wirescope 350, Microtest, OMNI Scanner and Fluke DSP-4000. Or approved equivalent

3. Execution

3.1. WARRANTY AND CERTIFICATION REQUIREMENTS

3.1.1. The Cabling 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 Cabling Contractor will provide a certification number within two weeks of award of this project.

3.1.2. The Cabling Contractor will provide letter(s) of Certification within two weeks of substantial completion of the project to the Communications Consultant. 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 Cabling Contractor shall forward copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the project to Tiree's office within 7 days of the award of contract. Provide a copy of the form with Specification submission.

END OF SECTION 27 08 00.00

1. General

1.1. WORK INCLUDED

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

1.2. EQUIPMENT LOCATIONS

1.2.1. 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.

1.3. PLYWOOD BACKBOARDS

1.3.1. 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.

1.4. COMMUNICATIONS RACKS AND CABINETS

1.4.1. All wall mount brackets, racks, cabinets and components shall be supplied and installed by the Cabling Contractor as indicated in this document and on the Contract drawings.

1.4.2. In all cases wall mount brackets, racks, cabinets and components shall be black.

2. Products

2.1. WALL MOUNT RACK WITH ENCLOSURE

2.2. EIA/TIA compliant wall mount open frame shall be Middle Atlantic Products model # WM-15-18 or approved equal. Please see Middle Atlantic for specifications.

2.2.1. A single wall mount rack shall be installed in each Telecom closet in each "POD" on each floor.

This equates to 2 per floor (8) plus 1 in Test Facility. Note 4th floor small POD is to be located in main IT room

2.3. COMMUNICATIONS RACK COMPONENTS

2.3.1. Overhead Cable Managers

The overhead cable manager must run the full width of the rack mounting space, including vertical cable managers and provide a minimum of 4" x 5" of cable management space. The overhead cable manager must have hinged front doors and back and side cuts to allow for Patch Cords. One overhead cable manager shall be installed for every rack (size to suit).

2.3.2. Vertical Cable Managers

The vertical cable managers (VCM) must run the full height of the rack mounting space and provide a minimum of 5" x 6" of cable management space for each side of each rack. The vertical cable manager must have hinged front doors and back and side cut outs to allow for Patch Cords. It must also have lancets along the back of the cable manager to allow for the fastening of the cable(s) to the outside of the manager itself. Two vertical Cable Managers shall be installed for every rack.

2.3.3. Horizontal Cable Managers

The horizontal cable managers (HCM) shall be compatible with standard 19" racks and shall include front cover. Each horizontal cable manager shall be 2 rack units (2U) in height. 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).

2.3.4. Power Bar

The power cord must be a minimum 6 feet in length to reach up to the ladder tray or down to the floor where it will plug into a receptacle (supplied by Division 26). Each rack shall be equipped with two (2) power bars. The power bar shall have several straight blade receptacles, be fused and non-switched. The power bars at the Main Communications at North Stand and Main Communications Room South Stand shall be rated 30A, 20V, while the power bars at the IDF location shall be rated 120V. Supply vertical power bars for Free Standing Racks and horizontal power bars for Wall mounted racks. The power bar(s) shall be UL/ULC listed and must meet UL/ULC 1363 and 1449 requirements.

2.3.5. Shelves

The Cabling Contractor shall supply and install rack mounted shelves as indicated on detail drawings.

2.4. COMMUNICATIONS CABINETS

2.4.1. All communications Cabinets to be supplied and installed for this project shall be manufactured and assembled to meet all requirements set forth below.

2.4.2. Each shelf must be able to bear a minimum weight of 200 lbs.

2.4.3. Components specific to each group of cabinets are as indicated below.

2.4.4. Cabinets

Each Server cabinet shall be a free standing, black, 30" W x 48" D floor mounted cabinet with 44U of mounting space, plexi front door, detachable side panels. All cabinets shall have six knockouts on top. Cabinets shall be ganged where possible.

2.5. COMMUNICATIONS CABINET COMPONENTS

2.5.1. Overhead Cable Managers

The overhead cable manager must run the full width of the rack mounting space, including vertical cable managers and provide a minimum of 4" x 5" of cable management space. The overhead cable manager must have hinged front doors and back and side cuts to allow for Patch Cords. One overhead cable manager shall be installed for every rack (size to suit).

2.5.2. Vertical Cable Managers

The vertical cable managers (VCM) must run the full height of the cabinet mounting space and provide a minimum of 5" x 6" of cable management space for each side of each rack. The vertical cable manager must have hinged front doors and back and side cut outs to allow for Patch Cords. It must also have lancets along the back of the cable manager to allow for the fastening of the cable(s) to the outside of the manager itself. Two vertical Cable Managers shall be installed for every cabinet.

2.5.3. Horizontal Cable Managers

The horizontal cable managers (HCM) shall be compatible with standard 19" racks and shall include front cover. Each horizontal cable manager shall be 2 rack units (2U) in height. 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).

2.5.4. Power Bar

The power cord must be a minimum 6 feet in length to reach up to the ladder tray or down to the floor where it will plug into a receptacle (supplied by Division 26). Each rack shall be equipped with two (2) power bars. The power bar shall have several straight blade receptacles, be fused and non-switched. The power bar(s) shall be UL/ULC listed and must meet UL/ULC 1363 and 1449 requirements.

2.5.5. Shelves

The Cabling Contractor shall supply and install rack mounted shelves as indicated on detail drawings.

2.6. GROUNDING KITS

2.6.1. All metallic equipment such wall mount brackets, racks and cabinets shall be grounded to the Telecommunications Grounding Busbar as specified under Section 27 05 26.00 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

2.7. PLYWOOD BACKBOARDS

2.7.1. The Cabling Contractor shall supply, install and layout the Plywood Backboard(s) as required. 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.

2.7.2. Offset Backboards

Backboards shall be mounted to 2" x 6" studs. All cables shall be fed from behind the Backboard to the IDC mounts, unless otherwise noted. Install offset backboards where required as shown on drawings.

2.7.3. Flush Backboards

Backboards shall be used for wall mounted racks, wall mounted cabinets, wall mount brackets, telephone equipment, service provider equipment, lightening 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. All communications racks shall be anchored to the floor, floor tile or wall by the Cabling Contractor.

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 installed by the Cabling Contractor as per the detail drawings. The Cabling Contractor shall supply and install (including levelling and ganging) all Racks, Cabinets and their components for a complete functioning system.

3.2. GROUNDING AND BONDING

3.2.1. All metallic equipment such wall mount brackets, racks and cabinets shall be grounded to the Telecommunications Grounding Busbar as specified under Section 27 05 26.00 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

END OF SECTION 27 11 16.00

1. General

1.1. WORK INCLUDED

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

1.2. HORIZONTAL CABLE IDC TERMINATION / MODULAR JACK CONNECTORS

1.2.1. The Horizontal cable IDC Termination Connectors ('Termination Connectors') shall have an insulation resistance of 100 mega ohms between clips.

1.2.2. The 'Termination Connectors' shall have a durability of 200 insertions/withdrawals of any combination of wire gauge.

1.2.3. The 'Termination Connectors' shall be FCC Part 68, subpart F compliant.

1.3. PATCH PANELS

1.3.1. The patch panels shall provide centralized termination, identification and service assignment point for UTP cabling and cordage in TE's/TR's/ER's.

1.3.2. The patch panels used to terminate the 4pair balanced twisted pair cable shall be available in 24 port 1U & 48 port 2U.

2. Products

2.1. IDC TERMINATION BLOCKS

2.1.1. All horizontal Voice cables shall be terminated on the BIX Block mounted at Backboard/Patch Panel mounted at Rack in the Telecom Room for that floor, unless otherwise specified in the scope of work (Section 17005) or drawings.

2.1.2. All cables shall be terminated using IDC termination mounts. The IDC connectors shall be able to terminate 22-26 AWG conductors. The IDC mount shall be capable of feeding the cables to the IDC connectors from behind the connector.

2.2. COPPER PATCH PANELS

2.2.1. All UTP horizontal Data cables shall be terminated on 1U, 24-port Modular Copper Patch Panels. All Modular Copper Patch Panels shall be black and shall be populated with UTP Modules as required (module colours and category shall meet requirements set out in Section). All unused openings on the Modular Copper Patch Panels shall be populated with black coloured blank inserts. Acceptable model Panduit CPP48WBLY or approved equivalent

2.2.2. All UTP horizontal Data cables shall be terminated on 2U, 48-port Modular Copper Patch Panels. All Modular Copper Patch Panels shall be black and shall be populated with UTP Modules as required (module colours to meet requirements set out in this section). All unused openings on the Modular Copper Patch Panels shall be populated with black coloured blank inserts. Acceptable model Panduit CPP48WBLY or approved equivalent.

2.2.3. All UTP Panels to have strain relief optional bars. (Panduit SRB)

3. Execution

3.1.1. NOT USED

END OF SECTION 27 11 19.00

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 Cabling 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 Cabling 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 Cabling 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 11 23.00

1. General

1.1. WORK INCLUDED

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

1.1.2. Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 26) to distribute the cables throughout the facility. Where the cables leave the pathways, and extend to the termination point they shall use cable support specified in this document.

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

1.1.4. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.1.5. Copper cabling requirements for this project will be reflected on communications backbone riser diagram(s)

1.1.6. All copper backbone cable is in conduit except those Copper Riser Backbone Cable running along vertically stack Telecom Room.

1.1.7. Communications Contractor to firestop the conduit sleeve after installing the cables. Also unused or spare conduit sleeve shall be firestop.

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 Consultant 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 Consultant and documented on as-built drawings.

1.3. BACKBONE LOCATIONS

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

1.4. MULTIPAIR CABLE

1.4.1. The Multipair cable shall meet the ICEA S-910-661-1997 and be compliant with Bellcore and REA specifications.

1.4.2. The Multipair cable shall meet or exceed the latest requirements of EIA/TIA-568B.

1.4.3. The cable shall have 24 AWG solid copper conductors and polyolefin insulation.

1.4.4. The cable core shall consist of 12 pair sub-units.

1.4.5. The cable shall have sequential length markings printed on the cable jacket.

1.4.6. The cable shall have one jacket equipped with a jacket splitting cord.

1.5. PIC SERIES CABLE

1.5.1. The PIC Series cable shall meet the NEMA Standard WC63.1-1006, ICEA S-910-661-1997 and be compliant with Bellcore and REA specifications.

1.5.2. The PIC Series Cable Campus cable shall meet or exceed the latest requirements of EIA/TIA- 568B.

1.5.3. The cable shall have 24 AWG solid copper conductors and polyolefin insulation.

1.6. CABLE RATINGS

1.6.1. The non-plenum/plenum cable shall be ETL or UL/ULC Listed and CSA Certified as type CMR/CMP, in accordance with the Binational Standard for Communications Cable, UL444/C22.2 No. 214-94.

1.7. CABLE CONNECTORS AND CLAMPS

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

2. Products

2.1. MULTI-PAIR BACKBONE CABLE

2.1.1. NOT USED.

2.2. CABLE LUBRICANT

2.2.1. Use non-corrosive cable lubricant where there is the potential for excess cable stress.

3. Execution

3.1. BACKBONE 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.

3.1.3. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available cable supports shall be used in the ceiling space to coil slack.

3.1.4. Neatly bundle and tie-wrap all cables using Velcro tie-wraps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes.

3.1.5. Pull all cables in a continuous run, no cable splices will be permitted.

3.1.6. Ground all cables and components to manufacturer's specifications and Standard practices.

3.1.7. Terminate all pairs of the Copper cable(s), unless specified elsewhere in this document.

3.2. OVERHEAD BACKBONE CABLE INSTALLATION

3.2.1. All cables identified as Overhead shall be installed via the indoor and outdoor pathways as provided by Division 26. Division 26 will install all indoor conduit and outdoor overhead poles complete with a messenger wire.

3.2.2. Over the entire length, Cables shall be installed so that they loosely lash around the messenger wire and/or are supported by suspension clamps. Every cable shall be individually and loosely lashed to the messenger wire to allow for expansion and contraction of the cables and messenger. Under no circumstance shall one of the cables be used to support other cables.

3.2.3. Minimise excess stress on the Copper cabling.

3.2.4. Installation of Cable(s) shall be with the use of a cable chute to pay out the cable as it is installed. Securely fasten the cable chute to the pole using a pole attachment and adapter.

3.2.5. Align the payout reel linearly with the pole and the direction of the cable travel. Locate the pay out reel a distance of twice the height of the messenger so as to avoid excess tension on the Cable as it is installed.

3.2.6. Use Cable Blocks or rollers at a distance of every 25 feet to support the cable or cables between poles.

3.2.7. Use a Cable Puller and Adjustable Pressure Brake assembly as necessary to prevent slack from pulling back onto the strand line when tension is removed from the pull line.

3.2.8. Use Spacers and Bands to separate the Cable from the Messenger Wire and hardware attached to the Wire. The Band shall be used to hold the Cable and Spacers next to the Wire, it should not be drawn too tightly on the Cable, and it should only support the Cable.

3.2.9. One flat bottom expansion loop shall be installed for every pole. Where distances between poles is greater than 200 feet, two flat bottom expansion loops are required. Every Cable installed should have a flat bottom expansion loop at every pole. Expansion loop shall be located directly at the pole. After the loop is formed, the Cable is lashed to the Spacer and the lashing wire shall be secured on one side. The lashing wire should be wrapped around the Wire three times and then tied off at the lashing wire clamp.

3.2.10. The Cabling Contractor will be required to make any necessary penetrations to building walls to pass the cables through the wall. Penetration size shall be minimised. All penetrations shall be sealed with outdoor silicone to ensure no moisture or water ingress into the buildings. The Silicone must be resistant to degradation from temperature cycles and UV exposure.

3.2.11. Use an approved cable guide and lashing device to secure the cable to the messenger strand.

3.2.12. Clamp cable to the exterior of the building with approved galvanised steel cable clamps.

3.3. CABLE BONDING

3.3.1. All backbone cables containing armouring or a metallic sheath must be grounded using a bonding clamp. All bond clamps shall attach the cable shield and be connected to the grounding busbar using minimum #6 AWG green grounding wire.

3.3.2. Ensure that the teeth of the bond clamp penetrate the cable sheath of all shielded cables.

3.4. CABLE LUBRICANT

3.4.1. Where there is potential for excess cable stress when pulling cables through conduit systems, apply a non-corrosive cable lubricant to the cable to facilitate pulling.

3.4.2. Completely remove all cable lubricant off cable(s) jacket as it exits the conduit system.

END OF SECTION 27 13 13.00

1. General

1.1. WORK INCLUDED

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

1.1.2. Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 26) 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.

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

1.1.4. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.1.5. All horizontal voice cables are to installed in cable tray and/or conduits (conduits by Div. 26).

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 Consultant 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 Consultant and documented on as-built drawings.

2. Products

2.1. VOICE HORIZONTAL UTP COPPER CABLE

2.1.1. All voice horizontal cabling shall be Unshielded Twisted Pair (UTP), 4 pair, 22-26 AWG, Category 6 cable and CMR-FT4/CMP-FT6 Rating as indicated below. The cable must be CSA certified and stamped accordingly. All UTP Voice cables shall have a white outer jacket colour. Approved model Panduit PUP6C04WH-U or approved equivalent.

2.1.2. All horizontal voice cables shall be CMR/FT4 rated except where found in plenum space and required by code, cable shall be CMP/FT6.

Execution

2.2. GENERAL CONDITIONS

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

2.3. HORIZONTAL CABLE DISTRIBUTION

2.3.1. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack.

2.3.2. Neatly bundle and tie-wrap all cables using Velcro tie-wraps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes.

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

2.3.4. When bundling Category 3, 5, 5e, 6 and Optical Fibre 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.

END OF SECTION 27 15 00.16

1. General

1.1. WORK INCLUDED

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

1.1.2. Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 26) 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.

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

1.1.4. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.1.5. All horizontal data cables shall be installed in conduits and cable trays to be installed by division 26.

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 Consultant 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 Consultant and documented on as-built drawings.

2. Products

2.1. DATA HORIZONTAL UTP COPPER CABLE

2.1.1. All data horizontal cabling shall be Unshielded Twisted Pair (UTP), 4 pair, 23 AWG, cable Category 6 and CMR-FT4 / CMP-FT6 Rating as indicated below. The cable must be CSA certified and stamped accordingly. The cable must be UL EPD certified. The color of the cable jacket shall be **blue**. Approved model is Panduit PUR6004BUY or approved equivalent.

2.1.2. All data horizontal cabling for Wi-Fi ACCESS POINTS shall be Unshielded Twisted Pair (UTP), 4 pair, 23 AWG, cable Category 6 and CMR-FT4 / CMP-FT6 Rating as indicated below. The cable must be CSA certified and stamped accordingly. The colour of the cable jacket shall be **orange**. Approved model is Panduit PUP6AM04OR-UG or approved equivalent

2.1.3. All horizontal data cables shall be CMR/FT4 rated except where found in plenum space and required by code to be fire resistant, cable shall be CMP/FT6 (UL 2043).

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 5/5e/6 cables and 25 mm (1”) for Category 3 cables.

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 tray.

3.2.2. Neatly bundle and tie-wrap all cables using Velcro tie-wraps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes.

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

3.2.4. When bundling Category 3, 5, 5e, 6 and Optical Fibre 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.

END OF SECTION 27 15 00.19

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. UTP MODULES

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

Environmental	Must be UL EPD certified.
Operating Temperature:	-10°C to 65°C
PoE Compliance	Rated for 2500 cycles with IEEE 802.3af /at and proposed 802.3bt type 3 and type 4
Conductor termination range	Wire cap compatible with 22-26 AWG solid or stranded cable with conductor insulation diameters of 0.060 in. max. and overall cable O.D. 0.200 in. to 0.330 in.

2. Products

2.1. UTP MODULES

2.1.1. The UTP modules must be matched appropriately with the cables to ensure that end to end Vendor Warranties will be applicable. All Horizontal UTP 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. Acceptable products are Panduit CJ688TG* and Panduit CJ6X88TG**

The UTP modules must be blue for 1G, orange for 10G data, white for voice, yellow for AV and green for security.

2.2. WORKSTATION OUTLETS

2.2.1. Modular Furniture Faceplate

All furniture outlets that have a modular furniture knockout shall utilise single-port modular furniture faceplate adapters. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.2.2. Wall Faceplate

Where wall boxes for Communications Contractor's use are not ganged with electrical outlet boxes, all wall outlets shall utilise single-port modular style flush-mounted faceplate adapters. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.2.3. Decora Adapters

Where wall boxes for Communications Contractor use are ganged with electrical outlet boxes, floor or raceway outlets shall utilise single-port Decora style adapters/inserts. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.2.4. Surface Mount Boxes

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

2.3. COVER PLATES AND DECORA STYLE BLANKS

2.3.1. The Cabling Contractor shall supply and install a total of 20 blank Insert Plates and Cover Plates for wall / floor outlets where needed.

2.4. BLANK INSERTS

2.4.1. 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 5/5e/6 cables and 25 mm (1") for Category 3 cables.

3.1.2. The Cabling Contractor must verify, with the Communications Consultant, the position of jacks prior to installation.

END OF SECTION 27 15 43.00

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 Cabling 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 Cabling 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 Cabling 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 16 13.00

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 Cabling Contractor without any additional compensation shall replace damaged cables.

1.2. OPTICAL FIBRE PATCH CORDS

1.2.1. Multimode Optical Fibre Patch Cords shall be made of 50/125 or 62.5/125 micron fibre with a maximum attenuation of 3.5 dB/km @ 850 nm and 1.25 dB/km @ 1300 nm and 0.5 dB/Km @ 1550 nm. Type of fibre Patch Cords shall be consistent with type of fibre backbone.

1.2.2. The Multimode Optical Fibre Patch Cord connector shall be multimode PC polish-type with ceramic ferrule with a typical insertion loss of 0.3 dB (guaranteed 0.5 dB) and a reflectance of –20 db.

1.2.3. Single mode Optical Fibre Patch Cords shall have a maximum attenuation of 0.8 dB/km @ 1300 nm and 0.5 dB/km @ 1550 nm.

1.2.4. The Single Mode Optical Fibre Patch Cord connector shall be either SPC or UPC polish-type with ceramic ferrule with a typical insertion loss of 0.15 dB (guaranteed 0.5 dB) and a reflectance of –40 dB for SPC and –55 dB for UPC.

1.2.5. The Optical Fibre Cord assembly shall be ST, SC, Duplex SC, FC or MT-RJ construction.

1.2.6. Multimode Optical Fibre Cords shall be orange and Single Mode shall be yellow.

1.3. DATA PATCH CORDS

1.3.1. 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.

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

2. Products

2.1. OPTICAL FIBRE PATCH CORDS

2.1.1. All Optical Fibre Backbone cable strands shall be connected to the Client supplied active equipment using Fibre Patch Cords. The Fibre Patch Cords shall be CMR rated FT4 and stamped accordingly. Fibre Patch Cords shall be consistent with the grade and manufacturer of the Fibre cable that is being warranted.

2.1.2. The Cabling Contractor is required to supply and install Fibre Patch Cords for complete connectivity of Fibre Cables. The Client reserves the right to switch the Fibre Patch Cords to a different configuration at no extra cost, 10 business days prior to delivery.

2.2. UTP COPPER PATCH CORDS

2.2.1. The Cabling Contractor is required to supply and install Patch Cords for complete connectivity of all Data Cables. The Cabling Contractor shall **supply and install two Patch Cords for every Data drop**. Patch Cords supplied and installed must maintain the Channel Solution. The lengths are as follows: Confirm with Nooga Consulting prior to final order.

Workstation/User Area	2m - Blue -Data
ER/TR Room	1 ft - Blue -Data

2.2.2. The Cabling Contractor shall **supply and install one Patch Cord at TR for every Voice drop** that is terminated on a patch panel**.**

2.3. CROSS-CONNECT WIRE

2.3.1. For the multipair Category 3 backbone cable, the Cabling Contractor shall supply and install Category 3 Cross-Connect wire. All Cross-Connect Wire supplied and installed must maintain the Structured Cabling Solution.

2.3.2. Cross-connects shall be made with wire of equal gauge and Category to that of the highest Category cable, which it is being connected.

3. Execution

3.1. OPTICAL FIBRE PATCH CORDS

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

3.2. UTP COPPER PATCH CORDS

3.2.1. Assume all horizontal cables shall be patched.

3.3. CROSS-CONNECT WIRE

3.3.1. Assume all pairs of backbone are cross-connected at both ends.

END OF SECTION 27 16 19.00