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**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results for Electrical.

**1.2 SUMMARY OF WORK**

- .1 The work includes: Supply and installation of fibre optic and copper backbone cabling, supply and installation of Augmented Category 6A Voice and Data Horizontal Distribution Cabling.
- .2 The voice/data communication systems shall comprise all components specified, implied or otherwise necessary to constitute a fully operational system. The work includes, but is not necessarily limited to, the following:
  - .1 Provision of cable termination panels, patch panels, and patch cords to support the system. Provision of equipment racks.
  - .2 Provision of direct horizontal runs of unshielded twisted pair (UTP) Category 6A cables.
  - .3 Provision of all cable supports and ties required to support the cabling system for this installation.
  - .4 Testing certification and warranty of all cabling and components which are within the scope of this Contract.
  - .5 Provision of as-built AutoCAD drawings fully documenting the cabling.

**1.4 REFERENCES**

- .1 All workmanship and materials supplied shall be in full conformance with applicable building, electrical, and other codes, as determined by the authority having jurisdiction.
- .2 All cabling system components shall be Underwriters Laboratories (UL) Listed and shall be marked as such. In cases where UL has no published standards for a component, any equivalent national independent testing standard shall apply and the item shall be appropriately marked.
- .3 The product specifications, design considerations, and installation guidelines provided in this document are in part derived from recommendations found in recognized telecommunications industry standards. The following are used as reference:
  - .1 Spaces and Pathways:
    - .1 TIA-569-B (2004) – Commercial Building Standard for Telecommunications Pathways and Spaces.
  - .2 Grounding:
    - .1 ANSI-J-STD-607-A (2002) – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

- .3 Cabling Systems:
  - .1 TIA/EIA-568-B.1 (2002) – Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
  - .2 TIA/EIA-568-B.2 (2001) – Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
  - .3 ANSI/TIA-568-B.2-10-2008 – Transmission Performance Specifications for 4- pair 100  $\Omega$  Augmented Category 6 Cabling.
- .4 ANSI/TIA/EIA-568-B.3-2000 - Optical Fiber Cabling Components Standard.
  - .5 ANSI/TIA/EIA-568-B.3-1-2002 - Optical Fiber Cabling Components Standard Addendum 1 – Additional Transmission Performance Specifications for 50/125m Optical Fiber Cables.
  - .6 TIA/EIA-862 (2002) – Building Automation Systems Cabling Standard for Commercial Building.
- .4 Cabling Administration:
  - .1 TIA/EIA-606-A (2002) – Administration Standard for Commercial Telecommunications Infrastructure.
- .5 Networking:
  - .1 IEEE Standard 802.3an (2006) – 10GBASE-T (10 Gb/s Ethernet operations over balanced twisted-pair cabling).
- .6 Design:
  - .1 BICSI Telecommunications Distribution Methods Manual (TDMM) – 11<sup>th</sup> edition.
- .7 Installation:
  - .1 BICSI Information Transport Systems Installation Manual (ITSIM) – 4<sup>th</sup> Edition (2004).

## 1.5 SYSTEM DESCRIPTION

- .1 Structured system of communication cables, copper Augmented Category 6 UTP and 850 nm laser-optimized 50/125  $\mu$ m optical fibre, installed within the building for distributing voice and data.
- .2 Connect each communication outlet in physical star configuration to Communications closet.
- .3 Installed in physical star configuration with separate horizontal and backbone sub-systems.
- .4 To avoid network problems caused by impedance balance, and attenuation differences, all passive equipment being installed in the horizontal network shall be of the same type and from the same manufacturer.

## 1.6 QUALIFICATIONS

- .1 The Contractor shall be a Certified System Vendor (CSV) experienced and trained by the manufacturing company, in all aspects of the placement, terminating, connecting and testing of products described herein and provide certificate of proof prior to start of work.

- .2 The Contractor shall have, or be “in the process” of obtaining “Certificate of Recognition” from the Nova Scotia Construction Safety Association.
- .3 The Contractor shall have a minimum of one (1) RCDD “Registered Communications Distribution Designer” recognized by BICSI “Building Industry Consulting Services International” on staff at local offices (the term “Local offices” as applied to RCDD, Registered Communications Distribution Designers, refers to anywhere in the Province of Nova Scotia) and provide certificate of proof prior to start of work.
- .4 Communications contractor shall supply and install a complete system for voice and data.
- .5 The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall demonstrate proven expertise in the implementation of network cabling. Expertise can be illustrated through the inclusion of details of at least three projects involving the design and installation of a Category 5e, Category 6, or Augmented Category 6 (Cat 6A) balanced twisted-pair cabling system within the past two-year period. Names and contact information for each of the three projects shall be included. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and proposed Augmented Category 6A metallic premise distribution systems and have personnel who are adequately trained in the uses of such tools and equipment.
- .6 The communications installer shall be a Communications Cabling Specialist certified by the Dept. Of Labour and obtain all required permits.

## **1.7 SHOP DRAWINGS**

- 1 Submit shop drawings and product data, for:
  - .1 Fibre optic cable
  - .2 UTP communication cable
  - .3 Communications Equipment Racks, Cable management
  - .4 Patch panels and patch cords
  - .5 Communication Outlets
  - .6 Bix mounts, connectors, adapters.

## **1.8 WARRANTY**

- .1 The warranty period with regard to the project is for 25 years from the date of Substantial Performance of the Work or those periods specified in the Contract Documents for certain portions of the Work of Products.
- .2 The Contractor shall be responsible for the proper performance of the Work.
- .3 The Contractor shall correct promptly, at the Contractor’s expense, defects or deficiencies in the Work which appear prior to and during the warranty periods specified in the Contract Documents.

- .4 The Departmental Representative, shall promptly give the Contractor notice in writing of observed defects and deficiencies that occur during the warranty period.
- .5 The Contractor shall correct or pay for damages resulting from corrections made under the requirements of paragraph 1.8.3.
- .6 The Contractor shall be responsible for obtaining Product warranties in excess of one year on behalf of the Departmental Representative from the manufacturer. These product warranties shall be issued by the manufacturer to the benefit of the Departmental Representative.
- .7 The Contractor shall provide a twenty-five (25) year Extended Product Warranty and Lifetime Application Assurance Warranty for the Communications Network. This warranty shall be backed up by the manufacturer and taken over by the manufacturer or his representative if the Contractor fails to follow through with the requirements of the warranty.
- .8 The Communications Network is defined as all required passive equipment and cabling, including hardware, terminations, and jacks, configured to provide data and voice connectivity from each data or voice outlet provided by the Contractor in this Contract.
- .9 The System Assurance shall cover the applications that the installed system is designed to support for a twenty-five (25) year period.
- .10 The copper system shall be constructed to conform to ANSI/TIA-568-B.2-10-2008 – Transmission Performance Specifications for 4-pair 100  $\Omega$  Augmented Category 6 Cabling Commercial Building Telecommunications Cabling Standards.
- .11 The Extended Product Warranty and the Systems Assurance together comprise the Structured Cabling System Quality Assurance Program.
- .12 Upon successful completion of the Structured Cabling System installation and subsequent testing by certified technical personnel the Contractor shall provide to the Departmental Representative a numbered certificate registering the installation.

## **PART 2 PRODUCTS**

### **2.1 GENERAL DESCRIPTION**

- .1 All Horizontal Fibre and Augmented Category 6 UTP Cable will be installed in conduit and cable tray as indicated. The principal cross-connection point for the riser system and for the voice network will be the Main Communication Room.
- .2 All horizontal voice and data distribution cables shall be terminated at the user end on a communications (single, dual or quad, as specified in drawings) outlet. The Data RJ-45 jack shall be appropriately numbered and identified with a Belden or equal computer label; the voice RJ-45 jack shall be appropriately numbered and identified with a Belden or equal telephone label.

- .3 Data Cable Installation and Termination:
- .1 Supply and install adequate number of 2-24-port patch panels in data rack to service all data distribution, plus 25% spare capacity (see drawing).
  - .2 Supply, install and terminate the horizontal (DATA) 4pr Augmented Category 6 UTP copper cables from data Distribution Patch Panels in Data Rack to each Data Outlet defined by the drawings. Each data jack shall be identified with the corresponding data patch panel port. Supply and install patch cords for all terminated data ports for both ends of each run.
  - .3 Supply and install horizontal and vertical cable management guides as per/drawing.
  - .4 Data patch panels shall meet Augmented Category 6 requirements/standards.

## **2.8 HORIZONTAL COMMUNICATIONS CABLE**

- .1 4 pair, Augmented Category 6 , #23 AWG insulated copper conductor, 100 ohm, Unshielded Twisted Pair (UTP) riser cable (CMR) in separate outer jacket for voice/data service distribution to communications cabinets and all outlets. All cable to have a minimum FT-4 fire rated jacket, white colour for voice & data. Augmented Category 6 cables shall be bonded pair. The cables shall have the individual conductors bonded along their longitudinal axis to ensure uniform spacing within each twisted pair.
- .2 Provide 4 pair, 23 AWG, UTP, Bonded Pair, CMR, Augmented Category 6 cable.
- .3 Augmented Category 6 cable shall be installed for all horizontal communications data and voice requirements. The balanced twisted-pair cabling system shall support 10 Gb/s networking and shall provide guaranteed performance up to 500MHz – ADD4 for a 4-connector, 100 m (328 ft) channel.
- .4 All Augmented Category 6 cables shall conform to ANSI/TIA-568-B.2-10-2008 – Transmission Performance Specifications for 4-pair 100  $\Omega$  Augmented Category 6 Cabling, CAN/CSA T529-95 Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section.

## **2.9 COMMUNICATIONS OUTLETS**

- .1 Data Outlets to be: Augmented Category 6, modular, 8 pin for voice and data; single, dual or four port c/w interface and mounting frame. Spare ports to be blanked off. Flush mounted.
- .2 Provide labelling as specified.

## **2.12 PATCH/LINE CORDS**

- .1 Patch and line cords shall be provided for all terminated voice and data ports, for both ends of each line. The cordage shall use 23 AWG solid copper conductors in a bonded pair configuration for reliable long-term channel performance to 625 MHz. The transmission characteristics of the cordage will be guaranteed to 625 MHz. The patch/line cords shall

support 10 Gb/s, various in length, FT-4, 23 AWG copper. Allow for lengths up to 3m, confirm exact prior to ordering.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION OF CABLES**

- .1 General:
  - .1 Install communication cables in accordance with Manufacturer's recommendations and guidelines.
  - .2 Place all communication cables in conduits or cable tray as required, except within closets use conduits as available.
  - .3 Cable Labels:
    - .1 Electrovert Type "Z" cable markers sized to fit cables snugly.
    - .2 Self laminating, heat-shrink, one-piece, custom printed cable labels. Cable labels can be self laminating embossed type in lieu of heat shrink.
  - .4 EMT type conduit "wall-stub" c/w flush installed device box shall be located in walls/partitions. Stubs shall be turned out into accessible ceiling space.
  - .5 Single and multi-gang type raised 4" square "tile" rings are also acceptable for use in new dry-wall type construction. Secure directly to face of metal studs. Multi-gang "tile" rings are to be adequately secured within partitions, on "both" left and right hand sides of same.
  - .6 Where the "grouping" of various systems outlets or multi type outlets in dry-wall type construction is desirable, the use of "box mounting brackets" are to be installed between, and secured to, both metal studs. To install suitably sized 4" square and/or 4 11/16" boxes c/w raised tile rings as may be required.
- .2 Installation of Unshielded Twisted Pair (UTP) Cable:
  - .1 Connect each outlet directly to a communications closets by a continuous UTP cable. There shall be no connector in the cable run between the communication outlet and the cable termination in the closet. Transition points between the communications closet and the communications outlet are disallowed.
  - .2 Horizontal cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundles, which will degrade the performance of those cables.
  - .3 The maximum horizontal cable distance for data and voice circuits to be 90 m (295 ft.). This is the cable length from the mechanical termination of the UTP cable in the communications closet to the communications outlet. In establishing maximum distance, an allowance to be made for 3 additional meters (9.8 ft.) from the communications outlet to computer and 2 meters for patch cords at the closet.
  - .4 Install coaxial cables and outlets in accordance with manufacturer's recommendations.
  - .5 When installing UTP cable, follow the separation distances from EMI sources detailed in the table:

SOURCE OF ELECTRO-MAGNETIC INTERFERENCE (EMI)	MINIMUM SEPARATION DISTANCE FROM A SOURCE CARRYING:	
	< 2 KVA	2 – 5 KVA
Unshielded power lines, electrical equipment near open/non-metal pathways.	12.7 cm 5 in.	30.5 cm 12 in.
Unshielded power lines, electrical equipment near grounded metal pathways.	6.4 cm 2.5 in.	15.2 cm. 6 in.
Power lines enclosed in grounded conduit.	5.0 cm 2.0 in.	7.6 cm. 3 in.
Transformers and electric motors.	1.02 m 40 in.	
Fluorescent lights.	30.5 cm 12 in.	

- .6 When terminating cables, the length of cable twist (twist/cm) shall be identical to that of the remainder of the cable. This twist shall be maintained up to 10 mm from the termination point of the cable at the patch panel and the receptacle.
- .7 UTP Cable Terminations:
  - .1 Terminate UTP cables at the work area outlet with an RJ 45 female connector.
  - .2 The cable colour code/jack pin assignments shall match (TIA jack-pin pair assignment) T568A.
  - .3 Terminate data cables directly to RJ-45 patch panels on equipment racks at the communications closet end and, connected to data hubs via patch chords.
  - .4 Maximum untwisted length of conductors shall not exceed 12mm (0.5 inch).
- .8 Identify each cable with a permanent indelible identification band which indicates the room and outlet number to which the cable is connected. Both ends of each cable must have identical identifier bands.
- .9 Identify each communication outlet with a permanent indelible label using standard numbering scheme.
- .10 Identify each patch panel position with the room and outlet number to which the cable is connected.

### 3.2 ACCEPTABLE TESTING AND CERTIFICATION

- .1 Category 6A performance tests shall be in accordance with ANSI/TIA-568-B.2-10-2008
- .2 Augmented Category 6A System Testing:
  - .1 For connecting hardware with modular interface components (ie. Plug and jack connectors) transmissions tests shall be performed with both components in a mated state on all 4 pairs, and shall meet the following performance criteria.

<b>PSANEXT</b>	70 dB @ 100 MHz
<b>Insertion Loss</b>	0.2 dB @ 100 MHz 0.45 dB @ 100 MHz
<b>Return loss</b>	28 dB @ 100 MHz
<b>TCL</b>	34 dB @ 100 MHz
<b>NEXT</b>	54 dB @ 100 MHz 40 dB @ 500 MHz

- .2 At a minimum, the balanced twisted-pair cabling system will exceed the key performance parameters for Augmented Category 6A found in ANSI/TIA-568-B.2-10-2008 – Transmission Performance Specifications for 4-pair 100 Ω Augmented Category 6 Cabling over the specified frequency ranges by the values listed below.

<b>PARAMETER</b>	<b>WORST CASE MARGIN (1 – 500 MHz)</b>	<b>WORST CASE MARGIN (500 – 625 MHz)</b>
Insertion loss	3%	Beyond Standard (*)
Return loss	2.0 dB	Beyond Standard (*)
NEXT	2.5 dB	Beyond Standard (*)
PSNEXT	3.5 dB	1.5 dB(*)
PSANEXT	2.0 dB	2.0 dB(*)
PSACRF	10.0 dB	8.0 dB(*)
PSAACRF	Beyond Standard	Beyond Standard (*)

Note: The **Margin** is the additional headroom (in dB or %) compared to the minimum specified value for Category 6A at each frequency point over the specified frequency range. The **Worst Case Margin** is determined at the frequency where the measured data point is closest to the limit line. The Category 6A limit line equations are used to determine the **Worst Case Margin** over the frequency range from 500 MHz to 625 MHz.

NEXT = Near-end crosstalk

PSACRF = Power-sum attenuation-to-crosstalk ratio far-end

PSAACRF = Power-sum alien attenuation-to-crosstalk ratio far-end

PSANEXT = Power-sum alien near-end crosstalk

PSNEXT = Power-sum near-end crosstalk

NOTE: The values listed above are characterized as “Margin” or “Guaranteed Headroom” beyond the performance specified in standards, and serve as additional assurance of the cabling system’s performance after installation and over its operational lifespan.

(\*) Value proposed or statement represent guaranteed margin against ANSI/TIA-568-B.2-10-2008 – Transmission Performance Specifications for 4-pair 100 Ω Augmented Category 6 Cabling extrapolated to 625MHz.

.3 Certification:

- .1 Certify that all cabling and hardware meets the performance criteria in this specification and is free from any optical, electrical or mechanical defects as a result of the installation and termination practices for a period of twenty-five (25) years from the time of acceptance by the Departmental Representative.

- .2 Provide two (2) copies of all installation documentation and reports. The minimum documentation set shall include:
  - .1 As-built drawings in paper format, fully documenting the cabling infrastructure. Copies of the approved drawings in AutoCAD “DWG” format shall be provided by the Departmental Representative to form a basis for as-built drawings.
  - .2 Records of all test procedures and test results in a report format and detailed tests results including graphical data in an electronic format.
  
- .4 Upon completion of the Work, the Departmental Representative shall carry out an onsite final inspection. As a minimum, the following points will be examined:
  - .1 Is the design documentation complete? Are all cables properly labelled, from end-to-end?
  - .2 Have all terminated cables been properly tested in accordance with the specifications for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and /or DC voltage?
  - .3 Is the cable type suitable for its pathway? Are the cables bundled in parallel?
  - .4 Have the pathways manufacturer’s guidelines been followed? Are all cable penetrations installed properly and fire stopped according to code?
  - .5 Have the Contractors avoided excessive cable bending?
  - .6 Have potential EMI and RFI sources been considered?
  - .7 Are conduit cable fills correct?
  - .8 Are hanging supports within 1.5 meters (5 feet)?
  - .9 Does hanging cable exhibit some sag?
  - .10 Are telecommunications closet terminations compatible with applications equipment?
  - .11 Have patch panel instructions been followed?
    - .1 Jacket removal point.
    - .2 Termination positions.
    - .3 All pair terminations tight with minimal pair distortions.
    - .4 Twists maintained up to Index Strip.
  - .12 Have modular panel instructions been followed?
    - .1 Cable dressing first.
    - .2 Jackets remain up to the Connecting Block.
    - .3 All pair terminations tight and undistorted.
    - .4 Twists maintained up to the Connecting Block.
  - .13 Are the correct outlet connectors used?
  - .14 Is the jacket maintained right up to the jack?
  - .15 Are all pairs tightly twisted and straight across in the Panel?
  - .16 Are identification markings uniform, permanent and readable?

### 3.3 COMMISSIONING

- .1 Building Commissioning is a requirement of this project in order to comply with sections of Division 01 – General Requirements. A Commissioning Agent has been engaged and will provide all systems commissioning in conjunction with all trade contractors. The

Commission Agent will provide a Commissioning Plan with commissioning start-up and test procedure sheets to be performed and completed by the various trade contractors.

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**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .4 Section 26 05 36 - Cable Trays for Electrical Systems.

**1.2 SYSTEM DESCRIPTION**

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, cabletroughs, pull boxes, sleeves and caps, fish wires, service fittings, concrete encased ducts.
- .2 Overhead and cabletrough distribution system.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal, conduit and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

**PART 2 PRODUCTS**

**2.1 MATERIAL**

- .1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Junction boxes, cabinets type: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

- .3 Outlet boxes, conduit boxes and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .4 Fish wire: polypropylene type.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install empty raceway system, including fish wire, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, miscellaneous and positioning material to constitute complete system.

#### **3.2 COMMISSIONING**

- .1 Building Commissioning is a requirement of this project in order to comply with sections of Division 01 – General Requirements. A Commissioning Agent has been engaged and will provide all systems commissioning in conjunction with all trade contractors. The Commission Agent will provide a Commissioning Plan with commissioning start-up and test procedure sheets to be performed and completed by the various trade contractors.

END