

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results - For Electrical.

### **1.2 REFERENCES**

- .1 CAN C22.1-2012 - Canadian Electrical Code.
  - .2 National Building Code of Canada 2010.
  - .3 National Fire Code.
  - .4 TBITS 6.9 - Treasury Board Guidelines for Telecommunications Installation.
  - .5 TIA/EIA-568 Commercial Building Telecommunications Cabling Standard.
  - .6 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces.
  - .7 TIA/EIA-570 Residential and Light Commercial Telecommunications Infrastructure Standard.
  - .8 TIA/EIA-606 Administration Standard for Commercial Telecommunications Infrastructure.
  - .9 TIA/EIA-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
  - .10 TIA/EIA-758 Customer Owned Outside Plant Telecommunications Cabling Standard.
  - .11 TIA/EIA-942 Telecommunication Infrastructure Standard for Data Centre.
  - .12 BICSI - Outside Plant Design Manual.
  - .13 BICSI - Telecommunication Distribution Methods Manual.
  - .14 BICSI - Information Transport System Installation.
  - .15 BICSI - Wireless Design Reference Manual.
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- .16 BICSI - Network Design Reference Manual.

NOTE: The above standards and codes apply to specifications and drawings.  
In the event of conflict, the most stringent and recent requirements SHALL apply.

### **1.3 DEFINITIONS**

- .1 Refer to TIA/EIA-598-C, Appendix M-1 for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

### **1.4 SYSTEM DESCRIPTION**

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fiber cables (F.O.), terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems.
- .1 Horizontal cables link work areas to telecommunications rooms.

### **1.5 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 As-built Records and Drawings:
- .1 Provide Microsoft Access database reflecting cable installation and cross-connections.
- .2 Provide two (2) bound complete hard-copy sets of as-built records to the Departmental Representative.
- .1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

### **1.6 QUALITY ASSURANCE**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
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## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with 01 10 10 - General Instructions.
- .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 for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal 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.

## **1.9 LEED DOCUMENTATION**

- .1 Submit LEED Material Submittal Form, as included in Section 01 35 21 - LEED 2009 Requirements to identify recycled content, regional content, or VOC emission when required by Submittal Requirements.

## **PART 2 - PRODUCTS**

### **2.1 HORIZONTAL DISTRIBUTION CABLE**

- .1 CAT 6 cable, 4 pair, 100 ohm, 24 AWG, thermoplastic insulated, solid copper conductor unshielded twisted pair (UTP), formed into four individually twisted pairs and enclosed by a thermoplastic jacket, sheath colour purple. Cable category identified on sheath.
  - .2 Fibre optic (F.O.) 2 strand, 50 micron laser optimized cables. Fibre Optic cable to the desktop, shall comply with the following specifications: Consist of a minimum of two (2) 50 µm laser optimized multi-coated fibres housed in individual 900 µm colour coded tight buffer tubes and have an aqua sheath.
  - .3 Cable certified as CMP per CSA Standard C22.2 No. 214094 and listed as NEC Type CMP per UL Standard 444.
  - .4 Cable jacket in conformance with CSA 22.2 No. 214 FT-6 fire rating.
  - .5 Cable in conformance with requirements of TIA-EIA-568-C.2.-1 and ISO/IEC 11801 Category 6 specification using Power Sum NEXT and ACR calculations.
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- .6 Cables provided by single manufacturer.

## **2.2 HORIZONTAL TERMINATION**

- .1 CAT 6 cables shall terminate to UTP Category 6 patch panels.
  - .1 Category 6 Patch Panels:
    - .1 Shall be made of a steel frame with black powder coat finish.
    - .2 Shall be modular and of Keystone format.
    - .3 Shall have port identification labels on front and rear
    - .4 Shall be made by an ISO9001 Certified Manufacturer.
    - .5 Shall meet or exceed the EIA/TIA Category 6 standard. Panels shall be of T568-A configuration.
    - .6 Shall be compatible with 482.6mm equipment racks.
  - .2 F.O. cables shall terminate to F.O. patch panels.
    - .1 Fibre Optic Patch Panels:
      - .1 Panels shall provide cross-connect, interconnect, splicing capabilities and contain cable management for supporting and routing of fiber cables/jumpers.
      - .2 Shall feature a front and rear access design with a hinged cover.
      - .3 Shall have a built in radius control.
      - .4 Shall be modular and in Keystone format opening to allow the possibility of changing connector types in the future without replacing the entire unit.
      - .5 Shall be sized to permit the termination of all fibres being installed and allow for future growth.
      - .6 Shall be equipped with a small form factor Duplex LC bulkhead "senior" version fitted within a keystone format opening.
      - .7 Shall be tested after installation to verify that the system meets the loss limit from patch panel to patch panel.
      - .8 Panels shall be mounted in 482.6 mm equipment racks.
      - .9 All equipment shall be certified as meeting the EIA technical specifications and must be installed as per the manufacturers guidelines and recommended installation methods.
  - .3 IDC (Insulation Displacement Connection) Terminal Strips
    - .1 IDC Terminal strips, 25 pair, for terminating multi pair 100 ohm balanced twisted pair cables and supporting cross-connections using jumper wires or compatible plug-end patch cords: Category 3 to: TIA/EIA-568-C.2.
    - .2 Mount block for housing IDC terminal strips on wall in MTR or telecom closet where applicable.
      - .1 Distribution rings or channels capable of externally mating with the above mount for managing cross-connection wires.

### **2.3 WORKSTATION TERMINATIONS**

- .1 Workstation Outlet Plates:
  - .1 Outlet plates shall be single gang configuration and white in color.
  - .2 Faceplates shall be modular and in Keystone format opening to allow the possibility of changing connector types in the future without replacing the entire unit.
  - .3 Faceplates shall be equipped with small form factor terminating connectors to fit the individual outlet's requirement (RJ45 and/or Dual LC bulkheads).
  - .4 Faceplates shall be equipped with a minimum of four (4) angled keystone openings. Contractors are to equip the faceplate with the required amount of blank inserts as required.
  - .5 When faceplates are equipped with a fibre optic port, it must be placed in the bottom keystone port position.
  
- .2 Workstation Termination Modules:
  - .1 Data/voice cables shall terminate using a keystone format jack to workstation insert modules.
    - .1 Insert modules shall meet or exceed the EIA/TIA Category 6 standard. The inserts shall be eight pin RJ45 IDC type connectors. Modules shall be compatible with outlet faceplates and shall be white in color, matching faceplate color. Shall accept four- or six-position modular plugs while providing proper electrical connection and not damaging telecommunication out/connector (jack).
  - .2 F.O. cables shall terminate using a keystone format jack to workstation insert module.
    - .1 Insert module shall be Duplex LC compatible adapter to: TIA/EIA 568 C.3.

### **2.4 TELECOMMUNICATIONS RELAY RACKS**

- .1 Overall dimensions 521 mm x 102 mm x 2085 mm.
  - .2 Fully welded 12-gauge steel construction, 44U usable space, EIA 310" 384 mm standard, c/w ground lugs.
  - .3 Steel base platter, 8 mm thick with 102 mm x 152 mm angles
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## **2.5 TELEPHONE CABLE**

- .1 Solid annealed copper conductors, foam skin insulation, twisted pairs.
- .2 Electrically continuous flat aluminum shielding tape with polyolefin film.
- .3 Polyethylene jacket.
- .4 RoHS compliant.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE**

- .1 Install termination and cross-connect hardware on wall in rack or in cabinet as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.
- .2 Install consolidation points, as indicated according to manufacturer's instructions. Identify and label as indicated to: TIA/EIA-606-A.

### **3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES**

- .1 Install horizontal cables as indicated in conduits, or ventilated cable trays from telecommunication rooms to individual outlets. Identify and label as indicated to: TIA/EIA-606-A.
  - .2 Terminate cables at outlets in conformance with CAN/CSA C22.2 No. 182.4, indicating the telecommunications room rack, patch panel, and part.
  - .3 Cables should be loosely bundled and secured using Velco or another similar product. Cables bundles may not be stressed or over cinched. Cables terminating at the patch-panel shall be dressed-in following standard craft practice. Hook and loop fasteners are acceptable.
  - .4 When terminating the UTP cable, the length of the cable twist (twist/cm) shall be identical to that of the remainder of the cable. This twist shall be maintained up to 12mm from the terminate point of the cable at the patch panel and the outlet jacks.
  - .5 When terminating the UTP cable, the maximum length of sheath removed shall be 19mm.
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### **3.3 INSTALLATION OF EQUIPMENT CABLES**

- .1 Install equipment cables from equipment terminal strips patch panel as indicated.
  - .1 Identify and label as indicated to: TIA/EIA-606-A.

### **3.4 IMPLEMENT CROSS-CONNECTIONS**

- .1 Implement cross-connections using jumper wires patch cords as specified.

### **3.5 FIELD QUALITY CONTROL**

- .1 Copper Tests
  - .1 Each pair of each cable installed shall be tested using a "green-light" test set that shows opens, shorts, polarity, and pair-reversals. Shielded / screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
  - .2 Each installed cable shall be tested for length using a TDR type device. The cable shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-A.2 Standard. Cable number and circuit or pair number.
  - .3 Cable shall be tested for permanent link.
  - .4 The test set to be used shall be Level 3 or above. Test sets to have been calibrated within the last 12 months and a copy of the test set "Certificate of Calibration" to be provided to the Departmental Representative.
  - .5 Category 6 data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
    - .1 Near End Crosstalk (NEXT)
    - .2 Attenuation
    - .3 Ambient Noise
    - .4 Attenuation to Crosstalk Ratio (ACR)
    - .5 Far End Crosstalk (FEXT)
  - .6 Test results shall be automatically evaluated by the equipment using the most up-to-date criteria from the TIA/EIA Standard and the result shown as pass/fail. Test results shall be printed directly from the test unit or from the test unit or from a downloaded file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

- .2 Fibre Optic Testing:
  - .1 Multimode fibres shall be tested at both 850nm and 1300nm and 1310nm and 1500nm in both directions. Test set-up and performance shall be conducted in accordance with ANSI/ EIA/TIA-526-14-A for multimode fibre. 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 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.
  - .2 Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable point. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables shall be evaluated based on the following formula; manufacturer's maximum attenuation per kilometer divided by 1000 and then multiplied by the installed cable length in meters. The adjusted cable attenuation value shall be added to the manufacturer's mean loss per mated pair of connectors multiplied by the number of mated pairs under test.
  - .3 The expected results for each cable (or group of cables of the same nominal length) shall be calculated before the start of testing and recorded in a space provided on the Contractor's test matrix. Each strand of fibre in the respective cable shall be evaluated against this target number. Any fibres that exceed this value shall be repaired or replaced at no cost to the Departmental Representative.
- .3 Hardware Tests:
  - .1 All hardware shall be tested after installation to ensure that the transmission criterion is met. For connecting hardware with modular interface components (i.e. plug and jack connectors), transmission tests shall be performed with both components in a mated state.