1. GENERAL

1.1 References

.1 Comply with latest edition of the codes and standards applicable and/or referenced Section 26 05 10

.2 The following is a list of standards that may be applicable in this Section:

.1 National Electrical Code (NEC) OFCR-LS; Sunlight Resistant (SUN RES).

.2 Institute of Electrical & Electronic Engineers, Inc.IEEE-383/IEEE-1202 flame test suitable for direct burial.

.3 Telecommunications Industry Association (TIA); Electronics Industry Association (EIA):

.1 568, Commercial Building Telecommunications Cabling Standard.

.2 569-D, Telecommunications Pathways and Spaces.

.3 607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

.4 Canadian Standard Association (CSA):

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, most current adopted edition.

.2 CSA C22.2 No.2556, Wire and cable test methods.

.3 CSA C22.2 No. 230, Tray cables.

.4 CSA C22.2 No. 232, Optical fiber cables.

.5 CSA C22.2 No 262, Optical fiber cable and communication cable raceway systems.

.5 American National Standard (ANSI/NETA).

.1 ANSI/NETA ATS, Standard For Acceptance Testing Specification for Electrical Power Equipment and Systems.

.6 Manitoba Hydro:

.1 Manitoba Electrical Code, most current adopted revision.

.2 Manitoba Hydro Inspection Notices.

.7 City of Winnipeg:

.1 Automation Design Guide.

.2 Electrical Design Guide.

.3 Winnipeg Electrical By-Law.

.4 Information Bulletins.

1.2 Abbreviations

.1	dB	decibel
.2	EIA	Electronic Industries Association
.3	m	meter
.4	MHz	megahertz
.5	µ, micro	x 10^{-6}
.6	n, nano	x 10^{-9}

1.3 System Description

.1 This section covers requirements for the Fibre Optic Network.

.2 Function of Fibre Optic Network is to transmit digital data between network nodes.

.3 Provide a Fibre Optic Network based on referenced standards for use in the site automation networks.

1.4 Submittals

.1 Action Submittals: Shop Drawings:

.1 Subsystem detail design documents:

.1 Bill of Materials for Fibre Optic Network Components: Component number, manufacturer, model number, component description, and quantity.

.2 Cable schedule showing:

.1 Cable identification.

.2 Fibre counts for each cable and identification of used fibre pairs.

.3 Cable length and attenuation and planned number of splices. Splices, if any, shall be minimized. Splices require Contract Administrator approval.

.3 Component Data:

.1 Manufacturer and model number.

.2 General data and description.

.3 Engineering specifications and data sheet.

.4 Scaled drawings and mounting arrangements.

.5 Power and grounding requirements.

.6 Electrical and optic interfaces.

.2 Informational Submittals:

.1 Manufacturer's statement that installer is certified to perform installation Work.

.2 Contractor Qualifications:

.1 Fibre Optic Network Contractor: Minimum of five (5) years' experience providing, integrating, installing, and commissioning of similar systems.

.2 Fibre Optic Network Subcontractor's Site Representative: Minimum of five (5) years' experience installing similar systems.

.3 Acceptance of Fibre Optic Network Subcontractor does not exempt Subcontractor or Contractor from meeting Contract requirements, nor does it give prior acceptance of subsystems, equipment, materials, or services.

.3 Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Quality Assurance.

.4 Manufacturer's suggested installation practice.

.5 Testing related submittals.

.6 Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data including the following:

.1 Updated versions of Hardware Shop Drawings Submittals.

.2 Component Manufacturers' O&M Manuals: Instructions for installation, operation, maintenance, and troubleshooting.

.3 List of spare parts provided.

.4 List of recommended additional spare parts.

.3 Factory Test Reports:

.1 Copy of Ethernet cable installer's factory certified installation certificate. Certificate shall have the name of the person who completed the training course and that person shall supervise all cable installation and termination for compliance with manufacturer recommendations.

.2 Copy of fibre optic cable installer's factory certified installation certificate. Certificate shall have the name of the person who completed training course and that person shall

supervise all cable installations and terminations for compliance with manufacturer recommendations.

1.5 Environmental Requirements

.1 Optical Fibre Cable and Cable Splice Centers:

.1 Outside, Underground/Submerged: Minus 20 to 40°C.

.2 Outside, Overhead: Minus 40 to 80°C.

.3 Outside, Aboveground in Conduit: Minus 40 to 75°C.

.4 Inside: 0 to 40°C.

.2 Equipment:

.1 Outside, Aboveground: Minus 40 to 75°C.

.2 Control Rooms, Equipment Rooms and Telecommunications Closets: 30 to 55 percent relative humidity, 18 to 24°C.

.3 Other Interior Areas: 0 to 100 percent relative humidity, 5 to 35°C.

2. PRODUCTS

2.1 Fibre Optic Cable

.1 Fibre Requirements:

.1 Multimode.

.2 Comply with the standards on References section.

.3 Fibre Core Diameter: 50 µm.

.4 Fibre Category: OM3.

.5 Wavelengths: 850 nm / 1300 nm.

.6 Maximum Attenuation: 3.0 dB/km / 1.0 dB/km.

.2 Cable Requirements:

.1 Type: Loose Tube, double jacket, chemical resistant, non-conductive.

.2 Application: Aerial, Direct Buried, Duct, Tray Rated.

.3 Flame Rating: LSZH (OFN-LS).

.4 Product Type: Dielectric.

.5 Temperature Range(operation): Minus 50 to plus 75°C.

.6 Fibre Count: 24.

.7 Fibres per Tube: 12.

.8 Tape: Water-swellable.

.9 Inner Jacket: FRNC/LSZH Material.

.10 Tensile Strength Elements: Dielectric strength members.

.11 Outer Jacket: FRNC/LSZH Material.

.12 Max. Tensile Strength, Short-Term: 4500 N.

.13 Max. Tensile Strength, Long-Term: 1500 N.

.14 Compressive Loading: 2400 N/cm.

.15 Impact Resistance: 11.8 N*m.

.16 Min. Bend Radius Installation: 264 mm.

.17 Min. Bend Radius Operation: 176 mm.

.18 Nominal Outer Diameter: 17.6 mm.

.19 Chemical Resistance: RoHS.

.20 Approvals: CSA FT-4-ST1.

.3 Manufacturer and Model:

.1 Corning 036TUL-T3680D2M.

.2 Or approved equal in accordance with B8.

2.2 Patch Cables

.1 In accordance with requirements of EIT/EIA 568, section 12.5.

.2 Features:

.1 Low Loss.

.2 2 fibres, LC duplex to LC duplex.

.3 50 µm Multimode (OM3).

.4 Wavelengths: 850 nm / 1300 nm.

.5 Zip Cord Tight buffered cable.

.6 Riser, 2.0 mm legs.

.7 Insertion loss, typical: 0.1 dB.

.8 Insertion loss, max.: 0.15 dB.

.9 Outer jacket material: LSZH/FRNC.

.10 Length: as required to suit installations without strain.

.3 Manufacturer:

.1 Corning E050502T5120001M and E050502T5120003M for 1 and 3 m.

.2 Or approved equal in accordance with B8.

2.3 Connectors

.1 LC duplex connectors to match existing installation.

3. EXECUTION

3.1 Installation

.1 Coordinate network cable installation with contractor's and City's activities at site. Provide at least five (5) business days notice before requiring access to facility to work in existing Network Panels or installing new.

.2 All network cabling within buildings to be installed in cable tray. Conduit runs are not permitted.

.3 Rod and swab out existing ducts prior to installing new cables. Inspect existing raceways and boxes for allowable bending radius prior to installing cable and notify the Contract Administrator of any condition which would prevent the proper installation of the cable.

.4 Install cable without splices between network components.

.5 Follow manufacturer's installation practices.

3.2 Fibre Optic Cable

.1 Installation by manufacturer certified installer.

.2 Install cables in accordance with manufacturer's requirements.

.3 Install cable directly from shipping reels. Ensure that cable is not:

.1 Dented, nicked, or kinked.

.2 Subjected to pull stress greater, or bend radius less, than manufacturer's specification.

.3 Subjected to treatment that may damage fibre strands during installation.

.4 If the link loss calculation indicates that the total cable system attenuation equals or exceeds the total link loss budget, rerouting may be allowed, if approved by Contract Administrator.

.5 Splices: Install fibre optic cables in unspliced lengths between fibre centers.

.6 Identification: Identify cable on both ends and in access holes and pull points it goes through. Identify with tags in accordance with Division 26. Use water proof tags.

.7 Sealing: Seal cables to stop ingress of water and grit with fabricated expansion plugs.

.8 Connect cables between destinations in cross-over configuration.

.9 Ground armoured cabling as close as practical to where the cables enter the building at one end only.

.10 Provide a 2 m coil for fibre cables terminating within cabinets. Coil neatly within the bottom of the cabinet.

.11 Provide a 3 m coil for fibre cables that are to be left unterminated. Cap off and store neatly within the destination room. Coordinate coil location with City staff to ensure coil is located in a suitable area, does not obstruct operations, and will not be exposed to damage.

.12 Access Holes:

.1 Provide supports for cables in access and hand holes at minimum 600 mm centres along sides.

.2 While maintaining minimum bend radius, lace cables neatly to supports to keep them out of way of personnel.

3.3 Field Quality Control

.1 Test components of installation in accordance with standards and specifications.

.2 Provide equipment, instrumentation, supplies and skilled staff necessary to perform testing.

.3 Advise Contract Administrator at least forty-eight (48) hours in advance of each test. Contract Administrator shall have option to witness and participate actively in tests.

.4 Document test results of each cable to confirm that at least specified number of fibres meet standards. Submit all test reports to the Contract Administrator to document the results of all of the testing requirements as well as the sate and conditions of the tests.

.5 Document results of repeater and transceiver tests.

3.4 Tests and Inspection

.1 In accordance with Division 01.

.2 Cable Inspection:

.1 Compare cable, connector, and splice data with drawings and specifications.

.2 Inspect cable and connections for physical and mechanical damage.

.3 Clean fibre connectors with specialty formulated cleaning solution if required, Follow cleaning kit manufacturer's instruction.

.3 Cable Testing:

.1 Field test all fibres for end to end attenuation of an installed link as per TIA-568-C.0 Test all spare fibres from patch panel to patch panel.

.2 The total link attenuation shall be less than its corresponding networking equipment loss budget.

.3 All tests shall be bi-directional.

.4 Perform cable length measurement, fibre fracture inspection and construction defect inspection using an Optical Time Domain Reflectometer (OTDR). The OTDR signal shall be analyzed for excessive connection, splice or cable backscatter by viewing the reflected power/distance graph.

.1 OTDR images shall be included in the test report.

.5 Perform connector and splice integrity test using an OTDR. The OTDR signal shall be analyzed for excessive connection, splice or cable backscatter by viewing the reflected power/distance graph.

.6 Perform cable attenuation loss measurement with an optical power loss test set. Attenuation loss, of each fibre, in dB/km shall be within manufacturer's recommendation.

.7 Perform connector and splice attenuation loss measurement from both ends of the optical cable with an optical power loss test set. Attenuation loss in shall be within manufacturer's recommendation.

.8 Until requirements are met, replace and retest all cables that do not have specified number of fibres that meet attenuation standards. The installation will not be considered complete until all requirements are met in all fibres even if communication is occurring.

.9 Submit a test report summary and all associated test data to the Contract Administrator at the completion of the testing.

END OF SECTION