SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections

1. Section 270524 – Communications Firestopping
2. Section 270526 – Grounding and Bonding for Communications Systems
3. Section 270528 – Pathways for Communications Systems
4. Section 271100 – Communications Equipment Rooms Fittings
5. Section 272100 – Data Communications System
6. Section 273100 – Telephony System
7. Section 274116 – Audio Visual Systems
8. Section 280513 – Conductors and Cables for Electronic Safety and Security
9. Section 281300 – Access Control
10. Section 282300 – Video Surveillance
11. Division 1 – General Requirements
12. Division 2 – Earthwork
13. Division 7 – Firestopping
14. Division 9 – Finish Painting
15. Division 11 – Equipment
16. Division 14 – Conveying Systems
17. Division 25 – Mechanical
18. Division 26 – Electrical

1.2 SUMMARY

A. Section Includes:

1. Multi-mode optical fiber cable.

2. Single mode, inside plant optical fiber cable.

3. Optical fiber cable connecting hardware, patch panels, and cross-connects.

4. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. IDC: Insulation displacement connector.

D. LAN: Local area network.

E. RCDD: Registered Communications Distribution Designer.

1.4 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

3. Cabling administration drawings and printouts.

4. Wiring diagrams to show typical wiring schematics including the following:
   a. Telecommunications rooms plans and elevations.

b. Telecommunications system access points.

5. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.

C. Fiber optic cable testing plan.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Test Results

B. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Manufacturers: Superior Essex/Ortronics, Berktek/Leviton, Panduit

B. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

D. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

E. Grounding: Comply with TIA-607-B.

2.2 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, MULTIMODE OPTICAL FIBER CABLE (OM3)

A. Description: Multimode, 50/125-micrometer, 12 and 24-fiber, armored, tight buffer, optical fiber cable.

B. Conductive cable shall be aluminum armored type.

C. Maximum Attenuation: 3.00 dB/km at 850 nm; 1.00 dB/km at 1300 nm.

D. Minimum Overfilled Modal Bandwidth-length Product: 1500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

E. Minimum Effective Modal Bandwidth-length Product: 2000 MHz-km at 850 nm.

F. Jacket:

1. Jacket Color: Aqua.

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

G. Comply with ICEA S-83-596 for mechanical properties.

H. Comply with TIA-568-C.3 for performance specifications.

I. Comply with TIA-492AAAC for detailed specifications.

J. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Conductive: Type OFNP, complying with NFPA 262.

2.3 9/125 MICROMETER SINGLE-MODE, INSIDE PLANT OPTICAL FIBER CABLE (OS2)

A. Description: Single mode, 9/125-micrometer, 12 fibers, single loose tube, armored optical fiber cable.

B. Conductive cable shall be aluminum armored type.

C. Maximum Attenuation: 0.7 dB/km at 1310 nm; 0.7 dB/km at 1550 nm.

D. Jacket:

1. Jacket Color: Yellow.

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches

E. Comply with TIA-492CAAB for detailed specifications.

F. Comply with TIA-568-C.3 for performance specifications.

G. Comply with ICEA S-83-596 for mechanical properties.

H. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.

2.4 OPTICAL FIBER CABLE HARDWARE

A. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

B. Patch Cords: Factory-made, dual-fiber cables in 36-inchlengths.

C. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Inter-mateability Standards (FOCIS) specifications of TIA-604-2-B for Type ST connectors, TIA-604-3-B for Type SC connectors, TIA-604-10-B for Type LC connectors, TIA/EIA-604-12 for Type MT-RJ connectors, and TIA-604-5-D for Type MPO connectors. Comply with TIA-568-C.3.

2. Quick-connect, simplex and duplex, Type LC connectors unless otherwise indicated on drawings. Insertion loss not more than 0.25 dB.

3. All terminations shall be fusion splice factory fabricated pigtails.

2.5 FIBER OPTIC CONNECTOR HOUSINGS

A. The connector housing shall be rack mounted in a standard 19” rack utilizing one, two three or four units of standard height (1.75 inch EIA hole spacing).

B. The connector housing shall utilize a modular connector plates for versatile connector configuration, with panels for SC, ST, and LC connectors.

C. The connector housing shall be capable of flush or partially flush mounting with a front protector that shall be capable of readily mounting any required labeling.

D. The connector housing shall be compliant with both ANSI/TIA/EIA-568A and ANSI/TIA/EIA-606.

E. The connector housing shall utilize a slide out drawer assembly.

F. The connector housing shall be capable of accepting a field installable lock mechanism.

2.6 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

C. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 301.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.1 and TIA-568-C.3.

2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."

3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

9. In the communications equipment room, install a 10-foot-long service loop on each end of cable.

10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feetlong not less than 12 inches in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with Section 270524 “Communications Firestopping”

C. Comply with TIA-569-D, Annex A, "Firestopping."

D. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: Class 2.

2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration including optional identification requirements of this standard.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

4. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

H. Backbone Risers

1. Each Main or Intermediate Cross Connect shall contain a lexan covered copy of the riser diagram(s) associated with the backbone cabling serviced by the Cross Connect.

2. The size of the plans shall be equal to the size of the Contract Drawings, unless Contract Drawings exceed 30” x 42”, in which case half size prints are to be utilized.

3. The plans shall be affixed by means of compression between the lexan cover and the backboard to which it is mounted. The Contractor shall make provisions to assure that the plans cannot accidentally fall from behind the lexan.

4. For cross connect locations that are smaller than TIA standard locations, half size plans shall be permitted.

5. For locations that are serviced by wall mounted enclosures in shared spaces with other trades, the Contractor shall provide a laminated 8 ½" x 11" plan of only the riser diagram and basic title block information. The laminated copy shall be attached in a semi-permanent fashion to the enclosure.

6. The Contractor shall utilize the final set of Record Drawings when providing these plans.

I. All Fiber Optic Backbone cabling shall be marked, at both ends, with the exact source and destination information, i.e. Telecommunications Space ID, rack, patch panel and ports, or punch down block ID and ports. Each label shall be approximately 2" from the end of the sheath.

J. All Fiber Optic cabling shall have a warning tape, stating, at a minimum, "WARNING: Fiber Optic Cable" at each point of cable pathway that is accessible by the Owner, Owner's personnel, or other Contractor, and every 10' along continuously accessible pathways through which the cable is routed, such as above lay in ceilings.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 SYSTEM AND SERVICE SHUTDOWN

A. Any systems or service shutdowns that must occur after such time that services have begun to be distributed on the SCS, shall be coordinated with the Owner, and the affected trades, prior to shutdown.

3.8 REPAIR AND RESTORATION

A. Any removal or rework of any structure or finish shall be restored to the original condition that the affected area was in prior to the removal or rework. All repairs and/or restoration shall be executed in a professional and workman like fashion by a tradesman skilled in such work. The Owner or Owner's authorized representative shall give written approval of all repairs and/or restoration upon its completion. Any repairs or restoration required as a function of work completed but not originally in project scope (i.e. accidental damage) shall be completed in same fashion outlined above at no additional cost to the Owner.

3.9 REINSTALLATION

A. All device and equipment that is either removed and returned to its original location or removed and relocated shall be tested as if new. Should any device or equipment prove to be unable to pass such test, the SCC shall contact the Engineer for a resolution. Such resolution shall be given in writing before proceeding with the execution of the resolution.

END OF SECTION 271323