

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT

PART 1 - GENERAL

- 1.1 This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA Medical Center here-in-after referred to as the "facility".

RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 **SUMMARY**

- A. This Section specifies Outside Plant infrastructure equipment including the following:
1. Building Protector Assemblies and Modules.
 2. Copper Splice Enclosures.
 3. Copper and Fiber Optic Splices and Connectors.
 4. Innerduct.
 5. Multi-pair Copper Cable.
 6. Single Mode Fiber Optic Cable.
 7. Multi-pair Cat 5E outdoor rated copper cable
 8. RG-11 Outdoor rated coax cable
- B. All work shall be performed by certified technicians and executed in a neat and workmanlike manner providing a thorough and complete installation. Work shall be properly protected during construction, including the shielding of soft or fragile materials.
- C. At completion, the installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of this portion of work shall be removed from the site.
- D. The Contractor must demonstrate to the Owner and Engineer that the systems are complete and complies with all operational requirements set forth in the plans and specifications.
- E. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications.
- F. It is the Contractor's responsibility to review the architectural, civil, structural, mechanical, and electrical drawings, as well as the specifications, for any details that may impact the installation or

provisioning of the system. Any discrepancies discovered shall be brought to the attention of the Engineer.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. ELECTRONIC INDUSTRIES ALLIANCE (EIA)
 - a. EIA TIA/EIA-455-204 (2000) FOTP-204 Measurement of Bandwidth on Multimode Fiber
2. INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
 - a. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable
 - b. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
 - c. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors
3. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
 - a. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits
4. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
 - a. NFPA 70 National Electrical Code - 2008 Edition
5. TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
 - a. TIA J-STD-607-A (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - b. TIA-455-107A (1999) Component Reflectance or Link/System Return Loss using a Loss Test Set
 - c. TIA-455-46A (1990) FOTP-46 Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
 - d. TIA-455-78-B (2002) FOTP-78 Optical Fibers - Part 1-40: Measurement Methods and Test Procedures - Attenuation
 - e. TIA-472D000-A (1993) Fiber Optic Communications Cable for Outside Plant Use
 - f. TIA-492CAAA (1998; R 2002) Class IVA Dispersion-Un-shifted Single-Mode Optical Fibers
 - g. TIA-526-14-A (1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - h. TIA-526-7 (2002) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant OFSTP-7
 - i. TIA-590-A (1997) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant

- j. TIA-758-A (2004) Customer-Owned Outside Plant Telecommunications Cabling Standard
 - k. TIA/EIA-455-B (1998) Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components
 - l. TIA/EIA-568-B.1 (2001 Addendums 2001, 2003, 2003, 2003, 2004, 2007) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements
 - m. TIA/EIA-568-B.2 (2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components
 - n. TIA/EIA-568-B.3 (2000; Addendum 2002) Optical Fiber Cabling Components Standard
 - o. TIA/EIA-569-A (1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces
 - p. TIA/EIA-598-B (2001) Optical Fiber Cable Color Coding
 - q. TIA/EIA-606-A (2002) Administration Standard for the Telecommunications Infrastructure
6. THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)
- a. SSPC SP 6 (2000; E 2004) Commercial Blast Cleaning
7. U.S. DEPARTMENT OF AGRICULTURE (USDA)
- a. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction
 - b. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant
 - c. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)
 - d. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2) RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)
 - e. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)
 - f. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)
8. UNDERWRITERS LABORATORIES (UL)
- a. UL 497 (2001; Rev thru Jun 2004) Protectors for Paired Conductor Communication Circuits
 - b. UL 510 (2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
 - c. UL 83 (2003; Rev thru Apr 2006) Standard for Thermoplastic-Insulated Wires and Cables

1.4 RELATED REQUIREMENTS

- A. Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM

1.5 DEFINITIONS

- A. Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, TIA/EIA-569-A, TIA/EIA-606-A, and IEEE Std 100 and herein.
- B. Campus Distributor (CD): A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).)
- C. Entrance Facility (EF) (Telecommunications): An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.
- D. Entrance Room (ER) (Telecommunications): A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.
- E. Building Distributor (BD): A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)
- F. Pathway: A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.6 SYSTEM DESCRIPTION

- A. The communications systems design provided for this project must comply with VAMC Dayton Fisher House specifications. These specifications also incorporate EIA/TIA 568 industry standards. The telecommunications outside plant consists of cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use.

1.7 CONTRACTOR QUALIFICATIONS/CERTIFIED PERSONNEL

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Installing Contractor shall have, as a direct employee of the Communication Cabling contractor, a minimum of one (1) RCDD on staff. This individual shall review all submittals, RFIs, change order proposals, and as built documents to insure compliance with EIA/TIA and BICSI standards. This individual shall also provide system engineering support and oversight of all field work to insure system installation

is fully compliant with all requirements of the latest editions of EIA/TIA 568, 569, 606 and 607.

2. Installing Contractor shall have, as direct employees of the Communication Cabling contractor, BICSI certified installers, contract employees or sub contracted installers will not be acceptable. It is the intent of the contract for the Installing Contractor to provide sole responsibility for material, labor, and service for the Communication Cabling system. Installing Contractor shall at a minimum, staff the project with BICSI certified installers for project foremen and crew leader positions.
3. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD.
4. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
5. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.

1.8 SUBMITTALS

Submittals shall be provided by the contractor prior to the purchasing and installation of the equipment described in this specification. Product submittals and Shop Drawing submittals shall be presented at the same time to the reviewing Engineer for evaluation. Product submittals shall be presented in electronic format with product data sheets in sequential order as described in Part 2.

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Submit manufacturer's data sheets on all system components. Data sheets shall be neatly bound with title page, index/bill of materials, and tab dividers for each major section. If multiple products or configurations are shown on the same product document, the product and or configuration to be supplied and installed on this project shall be highlighted.
 1. For cables, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- C. Submit as a separate section of the submittal book, resumes of the key staff assigned to this project, listing their experience and qualifications including a statement of the contractor's qualifications and abilities. Provide detailed information showing how the contractor will provide engineering, CADD support, fabrication and testing of equipment prior to delivery to job site, and service after installation is complete.

D. The format and details for the submittals shall include the following:

1. A complete bill of materials listing the following:
 - a. Applicable section/paragraph number from the project specification.
 - b. Manufacturer's name, model number (shall match spec sheet) and product description.
2. Specification sheets for all equipment used on the project shall be inserted in the same chronological order as appearing in the specifications. Pages printed or copied from the web page or instruction manuals will not be accepted.

E. Shop Drawings:

The contractor shall provide AutoCAD drawings detailing the information described below:

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. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

F. Refer to Division 1 for any additional requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide complete system including "punch down" and cross-connector blocks, voice and data distribution sub-systems, and associated hardware including telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, "patch" cables, "break out" devices and equipment cabinets, interface cabinets, and all miscellaneous equipment required to provide a complete system.
- B. Industry Standards:
 1. Cable distribution systems provided under this section are connected to systems identified as critical care performing life support functions.

2. Conform to National and Local Life Safety Codes (whichever are more stringent), NFPA, NEC, this section, Joint Commission Life Safety Accreditation requirements, and OEM recommendations, instructions, and guidelines.
3. Provide supplies and materials listed by a nationally recognized testing laboratory where such standards are established for supplies, materials or equipment.
4. Refer to industry standards and minimum requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and guidelines listed.
5. Active and passive equipment required by system design and approved technical submittal; must conform to each UL standard in effect for equipment, when technical submittal was reviewed and approved by Government or date when COR accepted system equipment to be replaced. Where a UL standard is in existence for equipment to be used in completion of this contract, equipment must bear approved NRTL label.

2.2 MATERIALS AND EQUIPMENT

- A. All Materials shall be new and UL listed.
- B. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems.

2.3 CONDUIT

- A. Provided under Division 26.

2.4 INNERDUCT

- A. All fiber optic backbone cables shall be installed within a fabric innerduct throughout all underground and rigid conduits. The fabric innerduct shall be a 3-cell construction for use in a 4" conduit. Provide two 3-cell fabric innerducts within each 4" conduit. The fabric innerduct shall be detectable with a metal detector.
- B. Acceptable Manufacturers- Maxcell or approved equals.

2.5 MULTI-PAIR COPPER BACKBONE CABLING

- A. Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor shall verify distances between splice points prior to ordering cable in specific cut lengths.
- B. Compliance: Rural Utilities Service (RUS) 7 CFR 1755.890 (REA PE-89)
- C. Conductors: Solid, annealed copper sizes, 24 AWG
- D. Insulation: Dual insulation consisting of an inner layer of foamed polyolefin surrounded by a solid polyolefin skin, color coded in accordance with telephone industry standards

- E. Twisted Pairs: insulated conductors are twisted into pairs with varying lay lengths to minimize crosstalk
- F. Core Assembly: arranged in groups, each group having a color coded unit binder
- G. Filling Compound: The entire core assembly is completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.
- H. Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.
- I. Aluminum Shield: Corrugated, copolymer coated, 0.008" aluminum tape applied longitudinally with an over lap. The sheath interfaces are flooded with an adhesive water blocking compound.
- J. Jacket: Black, linear low density polyethylene.
- K. Basis of Design:
- L. 110 WALL BLOCKS

- 1. Provide 100 pair 110 wall blocks as required for termination of Category-3 backbone cables on the plywood backboard in the ER. Provide a minimum of one (1) 110 block for carrier cross-connect.
- 2. 100 pair 110 blocks shall be tested and verified to meet and exceed Category-5e ANSI/TIA 568-C.2 connecting hardware specifications to support both high-speed data and voice applications.
- 3. 110 wiring bases and blocks shall be made of fire-retardant plastic rated UL 94V-0.
- 4. 100 pair 110 wall blocks shall include mounting frame, vertical and horizontal cable management, four pair or five pair connector blocks as required, clear label holders, and white designation strips. 100 pair 110 tower wall blocks shall be securely mounted to plywood backboards.

2.6 FIBER OPTIC CABLE

- A. All single-mode fiber optic cabling shall be 9.3/125um and contain the number of strands as indicated on the drawings.
- B. All single mode fiber shall be armored and rated for outdoor installations.
- C. The cable jackets shall be clearly marked from the factory indicating the fiber type and rating. Loose buffer cable shall be used outside.
- D. The single mode backbone fiber shall meet the following physical specifications.

Fiber Attribute (Depressed Cladding)
Cladding Diameter: 125.0 ± 1.0 µm
Cladding Non-Circularity: ≤ 1.0%
Colored Fiber Diameter: 250 ± 15 µm
Core Diameter: 8.3 µm

Core/Cladding Concentricity: $\leq 0.8 \mu\text{m}$
Minimum Proof Strength: .70 Gpa (100 kpsi)
Fiber Curl: >2m
Fiber Macrobend (100 turns @ 32 mm diameter) $\geq 0.05 \text{ dB @ } 1310 \text{ NM}$, $\geq 0.10 \text{ dB @ } 1550 \text{ NM}$
Fiber Macrobend (1 turn @ 32 mm diameter) 0.5dB @ 1550m
Coating Strip Force: $1.3 \text{ N} \leq F \leq 8.9 \text{ N}$
Dynamic Tensile Strength (Unaged): >55kpsi (3.8 Gpa)
Dynamic Tensile Strength (aged): >440kpsi (3.0 Gpa)
Dynamic Fatigue: >20
Static Fatigue: >20
Operating Temperature: -40°F to 158°F

- E. The single mode campus backbone fiber shall meet the following optical specifications.

Index of Refraction: 0.37%
Mode Field Diameter: $8.8 \pm 0.5 \mu\text{m @ } 1310 \text{ NM}$
Attenuation: 0.4 dB/km @ 1310 NM; 0.3 dB/km @ 1550 nm
Attenuation at Water Peak: 2.0 dB/km @ 1350nm
Point Discontinuities: 0.1 dB
Zero-Dispersion Wavelength: $1310 \pm 10 \text{ nm}$
Zero-Dispersion Slope: 0.092 ps/m ² -km
Maximum Dispersion: 2.8 ps/NM-km, 1285 to 1330 NM
Fiber Cutoff Wavelength: $\geq 1150 \text{ NM}$, $\geq 1300 \text{ NM}$
Cable Cutoff Wavelength: $< 1260 \text{ nm}$

- F. The multi mode campus backbone fiber shall be 62.5/125, OM1.
- G. The multi mode campus backbone fiber shall be outdoor rated, Loose tube type, Orange color.

Optical Characteristics:		62.5/125
Maximum finished cable attenuation coefficient	@ 850nm	3.5dB/km
	@1300nm	1.0dB/km
Overall Launch Bandwidth	@850nm	200MHz.km
	@1300nm	500MHz.km
Laser Bandwidth	@850nm	220MHz.km
Gigabit Ethernet Link Leng (1 Gbps)	1000 base-sx (850nm)	300 meters
	1000base-lx (1300nm)	550 meters
10 Gigabit Ethernet Length (10 Gbps)	10G base-sr (850nm)	33 meters

- H Fiber Optic Interconnect Centers / LIU's

1. Fiber optic interconnect centers for Rack Mounting shall provide capacity for the termination of all fiber optic cable strands utilizing 12 port adapter panels. Provide 2 spare panel openings in each interconnect center for future growth.
2. Fiber optic LIU's for Wall Mounting shall provide capacity for the termination of all fiber optic cable strands utilizing 12 port adapter panels. Provide 2 spare panel openings in each interconnect center for future growth.
3. Fiber optic interconnect centers shall allow for rear/side entry of backbone fiber for termination and front patching. Interconnect center shall contain a locking hinged Plexiglas front door with front and side cable openings for fiber patching extensions.
4. Splice trays compatible with heat shrink sleeve protectors shall be provided to house and protect all fusion splices.
5. Fiber Optic Splice Shelves shall be provided for the storage of all splice trays. Splice Trays shall not be installed in the Fiber Optic Interconnect Centers. Fiber Optic splice shelves shall provide sufficient capacity to support up to 6-12 port splice trays and provide internal routing of the fiber optic strands to the fiber optic interconnect center.
6. Snap in adapters with 6 duplex LC connectors shall be provided. High density adapters that accommodate more than twelve strands of fiber will not be accepted.
7. Blank modules shall be provided to fill all unused openings.
8. Multi-mode connector shall be Orange and single mode connectors shall be yellow.
9. Bend radius guides and looping brackets shall be provided concealed in rear of frames for management of fiber slack.
10. All single-mode fibers shall terminate in independent adapter modules from the multi-mode fiber adapters.
11. Interconnect centers shall be supplied with the following accessories: Fiber cable management, cable strain relief mounting kits, fusion splice sleeves, and splice tray with mounting hardware kit.
11. Provide adapter plates with six duplex LC connectors to match interconnect center supplied. Single-mode connections shall be blue, multimode connections shall be aqua, APC connections shall be green.
12. Provide blank modules for all unused spaces from manufacturer of interconnect center.

F. FIBER OPTIC CONNECTORS

1. All fiber cables (Multimode and Single mode) shall terminate in "LC" type connectors utilizing fusion spliced factory pigtail termination kits. Provide dust covers for all connectors. Provide heat shrink sleeves for all fusion splices.
2. All fiber optic pigtails shall be from the same manufacturer as the fiber optic interconnect centers.
3. Pigtails shall be provided in sufficient quantity to terminate all strands in the fiber optic interconnect centers.

4. Multi-mode pigtails shall be 900 micron tight-buffered, laser optimized, 3 meters in length and have a simplex LC connector. Multimode insertion loss: < 0.5dB (0.25dB typical). Multimode return loss: better than -25dB. Minimum 50/125µm laser optimized fiber effective mode bandwidth: 2000 MHz-km @ 850nm. Mating durability: 500 matings per FOTP-21. Operating/storage temperature: -40°C to 75°C.
5. Single mode pigtails shall be tight-buffered, OS2, 3 meters in length and have a simplex LC connector. Singlemode insertion loss: < 0.35dB (0.15dB Typical). Singlemode return loss: better than -55dB. Mating durability: 500 matings per FOTP-21. Operating/storage temperature: -40°C to 75°C.

2.7 COAXIAL CABLE BACKBONE

A. RG-11 COAXIAL CABLE

1. Minimum performance specifications shall be:
 - a. Center Conductor: 0.109" solid copper clad aluminum.
 - b. Dielectric: Micro-cellular Foam PE core insulation.
 - c. Shield: Solid aluminum tube.
 - d. Jacket: Medium Density PE Jacket with water-blocking material meant for underground installation.
 - e. Nominal DC resistance 2.6 ohms (maximum) per 1000 feet.
 - f. Nominal capacitance of 16.3 pf/ft (maximum).
 - g. Nominal velocity of propagation 87% nominal.
 - h. Attenuation per 100 feet (30.5 m) shall not exceed 2.6 dB at 1,000MHz.
 - i. 75 ohm nominal impedance.
2. All coaxial cables shall be factory sweep tested from 5 to 1000 MHz. Contractor shall sweep test all coaxial cables after installation and verify performance to 1000 MHz.
3. All coaxial cables shall be terminated with an appropriate single piece male "F" connector. Connectors with separate crimp rings will not be accepted. Connectors and installation tooling shall be approved by the cable manufacturer for use with the specified cable.
4. All coaxial video cabling shall be outdoor rated, wet listed and black in color.

2.8 GROUNDING AND BONDING CONDUCTORS

- A. Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA J-STD-607-A, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B 1 for sizes No. 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B 8, for sizes No. 6 AWG and larger. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.9 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

- A. Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags shall be stainless steel or polyethylene and labeled in accordance with TIA/EIA-606-A. Handwritten labeling is unacceptable.

2.10 BURIED WARNING AND IDENTIFICATION TAPE

- A. Provide fiber optic media marking and protection in accordance with TIA-590-A. Provide color, type and depth of tape per industry standards.

2.11 GROUNDING BRAID

- A. Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid shall be made from flat tin-plated copper.

2.12 MANUFACTURER'S NAMEPLATE

- A. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.13 FIELD FABRICATED NAMEPLATES

- A. Provide laminated plastic nameplates in accordance with ASTM D 709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.14 TESTS, INSPECTIONS, AND VERIFICATIONS

- A. Test 100 percent OTDR test of FO media at the factory in accordance with TIA/EIA-568-B.1 and TIA/EIA-568-B.3. Use TIA-526-7 for single mode fiber and TIA-526-14-A Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), shall meet the requirements of ICEA S-99-689. Enhanced performance air core OSP copper cables shall meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Install cables in raceways and cable trays except within consoles, cabinets, desks and counters. Conceal raceway and cables except in unfinished spaces.

- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Bundle, lace, and train cables within cabinets, racks and 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 as required.

3.2 **INSTALLATION OF CABLES**

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Install 110-style IDC termination hardware unless otherwise indicated.
 - 3. Terminate all conductors; no cable shall contain unterminated elements unless noted specifically on the plans. 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 48 inches and not more than 12 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 conductors to terminal points without exceeding manufacturer's limitations on bending radii. Use d-rings, j-hooks, lacing bars and distribution spools as required.
 - 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 unreeling. Heat lamps shall not be used for heating.
 - 9. In the technology equipment rooms, install a 20 foot long service loop on each end of cable. Service loop shall be stored in the cable tray installed along the perimeter of the room.
- C. Optical Fiber Cable Installation:
 - 1. Comply with TIA/EIA-568-B.3.
 - 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- D. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend UTP cable not in a wireway or pathway, a minimum of 6 inches above ceilings, by cable supports not more than 48 inches apart.

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

3.3 FIRESTOPPING

- A. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

3.4 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

- B. Cable and Wire Identification:

1. Label each cable between 2 and 6 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 **25 feet**.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually numbered wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. 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.

- C. 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/EIA 606-A, for the following:

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

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Optical Fiber Cable Tests:

- a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.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) Multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
- 2) Single mode backbone link measurements: Test at 1310 or 1550 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
- 3) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

3.6 CLOSE OUT DOCUMENTATION

- A. In addition to the requirements described in Section 27 01 00 Operations and Maintenance of Communication Systems, the installation contractor shall provide a separate tab identified as BACKBONE CABLING TEST RESULTS and a separate tab identified as MANUFACTURE WARRANTY. All backbone test results shall be presented for Engineer evaluation and included in the Manufacturer's Application and Performance Warranty and Inspections.
- B. Items mentioned in paragraph A above shall be presented with the contractor's final as-built drawings as a complete package. Only complete packages will be reviewed. Partial packages will be rejected.

END OF SECTION 33 82 00