



APPENDIX B: MATERIAL SPECIFICATIONS

TABLE OF CONTENTS

BFO-1 DROP 100'	3
BFO-1 DROP 100'	3
BFO-1 DROP 500'	3
BFO-2	3
BFO-24	3
BFO-96	3
BFO-288	3
CO-1 DROP 100'	3
CO-1 DROP 250'	3
CO-1 DROP 500'	3
CO-1 DROP 750'	3
CO-1 DROP 1000'	3
CO-2	3
CO-24	3
CO-48	3
CO-96	3
CO-144	3
CO-288	3
BHF (13x24x18)	6
BHF (17x30x24)	6
BHF (30x48x24)	6
BHF (30x48x36)	6
BD5	7
BM2 (5/8)(8)	8
HBFO (L): BURIED FOSC 450D	9
HBFO (M): BURIED FOSC 450B	9
HAPO(L): AERIAL FOSC 450D	9
HAPO(M): AERIAL FOSC 450B	9
V(1)1.25	10
V(2)1.25	10
V(3)1.25	10
PON Cabinet (96-Port)	12
PON Cabinet (144-Port)	12
Telecommunications Optical Broadband Cabinet	13
2 MST 100'	16
2 MST 250'	16
2 MST 500'	16
2 MST 750'	16
2 MST 1000'	16
4 MST 100'	16



4 MST 250'	16
4 MST 500'	16
4 MST 750'	16
4 MST 1000'	16
6 MST 100'	16
6 MST 250'	16
6 MST 500'	16
6 MST 1000'	16
8 MST 1000'	16
SNO-SHOE	17
10M STRAND	19
BM82	20
PE1-3	21
PE2-3	21
PF1-5	22
PM11	23
PM12	24
GROUND PM2A	25
Fiber Glass Extension Arm	26
NID	27
1:32 splitter.....	28
1:64 splitter.....	28



Item Number	Item Description
BFO-1 DROP 100'	Place 1 Strand Fiber in Conduit (100' Cable Distance).
BFO-1 DROP 250'	Place 1 Strand Fiber in Conduit (250' Cable Distance).
BFO-1 DROP 500'	Place 1 Strand Fiber in Conduit (500' Cable Distance).
BFO-2	Place 2 Strand Fiber in Conduit
BFO-24	Place 24 Strand Fiber in Conduit
BFO-96	Place 96 Strand Fiber in Conduit
BFO-288	Place 288 Strand Fiber in Conduit
CO-1 DROP 100'	Attachment 1 Strand Fiber to Poles (100' Cable Distance).
CO-1 DROP 250'	Attachment 1 Strand Fiber to Poles (250' Cable Distance).
CO-1 DROP 500'	Attachment 1 Strand Fiber to Poles (500' Cable Distance).
CO-1 DROP 750'	Attachment 1 Strand Fiber to Poles (750' Cable Distance).
CO-1 DROP 1000'	Attachment 1 Strand Fiber to Poles (250' Cable Distance).
CO-2	Attachment 2 Strand Fiber to Poles.
CO-24	Attachment 24 Strand Fiber to Poles.
CO-48	Attachment 48 Strand Fiber to Poles.
CO-96	Attachment 96 Strand Fiber to Poles.
CO-144	Attachment 144 Strand Fiber to Poles.
CO-288	Attachment 288 Strand Fiber to Poles.

A. General Requirements

The SMFO cable shall meet the following industry standards for design and manufacture:

- a) Telcordia Generic Requirements of Optical Fiber and Optical Fiber Cable (GR-20)
- b) International Telecommunication Union, Characteristics of a bending-loss insensitive single mode optical fiber and cable (ITU-T G.657)

Unless otherwise stated, all fiber optic cable shall be SMFO cables that are of gel-filled buffer tube construction or powder-filled buffer tube construction, with carbon black polyethylene jacket material, and constructed by a certified ISO 9001 or 9002 manufacturer. The Vendor shall provide certification that the cables furnished and installed are in conformance with the manufacturer specifications. This certification shall be in two parts:

- a) The Vendor shall secure a certification from the cable manufacturer that the cable is in conformance with the Rural Electrification Administration (REA) Bulletin 1753F-601 (PE-90a), where applicable, and these Specifications.
- b) The Vendor shall submit a Certificate of Compliance demonstrating that the communication cable subsystem has been installed and spliced in accordance with the fiber optic cable and fiber optic splice closure manufacturer's recommendations, standard industry practice, and specifications.



B. Warranty

Each item of the communication cable subsystem shall be warranted by the Vendor against all defects in material and workmanship.

C. Fiber Optic Cable Performance and Specifications:

The SMFO cable furnished and installed by the Vendor shall meet the following requirements:

Fibers per cable:	1-strand Drop Cable 2-strand Drop Cable 24-strand Distribution Cable 48-strand Distribution Cable 96-strand Distribution Cable 144-strand Distribution Cable 288-strand Feeder Cable
Coating diameter:	245 ±10 µm
Cladding diameter:	125 ± 1 µm
Core to cladding offset	≤ 0.8 µm
Cladding non-circularity:	≤ 1.0%
Mode field diameter:	9.2 µm nominal
Maximum attenuation:	≤ 0.4 dB/km at 1310 nm; ≤ 0.3 dB/km at 1550 nm
Minimum storage temperature range:	- 30 to + 70 degree C
Minimum installation temperature range:	- 10 to + 40 degree C
Minimum operating temperature range:	- 30 to + 70 degree C
Wavelength:	1310/1550 nm
Cable construction:	Gel-Filled Buffer Tube or Powder-Filled Buffer Tube
Outer jacket:	Carbon Black Polyethylene
Bending radius storage:	10-inch minimum
Bending radius Installation:	6-inch minimum
Tensile Strength Installation:	600 lbf for pulling standard outside plant (OSP) Between 100-300 lbf for jetting fiber.
Rated life:	Certify a 20-year life expectancy when installed to manufacturer's specifications



D. Tensile Strength Members:

Underground fiber optic cable shall withstand a 600 lb tensile load applied per EIA-455-33 where the change in attenuation does not exceed 0.2 dB during loading and 0.1 dB after loading. Use cable rated for an installed tensile service load of 200 lbs or more.

E. Environmental:

The fiber optic cable shall be capable of withstanding the following conditions without damage or decrease in function:

- Cable operating temperature per EIA/TIA-455-03;
- Total immersion in water with natural mineral and salt contents;
- Salt spray or salt water immersion for extended periods.

F. Cable Length and Shipping:

The Vendor shall base the length of each fiber optic cable on provided quantities (reasonably rounded up to the nearest reel size). Stencil, letter, or provide the following information on a weatherproof tag firmly attached to the reel:

- Factory order number;
- Job number;
- Ship date;
- Manufacturer's cable code;
- Type of cable (single mode, outdoor, indoor);
- Beginning and ending length markings;
- Direction;
- Measured length and attenuation; and
- "Index of Refraction" from Acceptance Test and the wavelength it was tested at.

G. Cable Markings

The color of the outer jacket shall be black. The completed cables shall have sequential length markers in a contrasting color to the cable jacket, at regular intervals of three feet along the outside of the jacket. Printed on the jacket shall be the cable code to identify the number and type of fibers, the manufacturer's name, manufacture's part number, the year of manufacture and the sequential length markings. The marking shall be readable and proportionate in height to the cable and must be permanent and weatherproof.

H. Color Coding

The single mode trunk cable "buffer tube" outer jackets and fiber jackets shall be colored in accordance with TIA-598, Revision D.



Item Number	Item Description
BHF (13x24x18" Deep)	Buried Fiber Optic Handhole (13"x24"x18" Deep)
BHF (17x30x24" Deep)	Buried Fiber Optic Handhole (17"x30"x24" Deep)
BHF (30x48x24" Deep)	Buried Fiber Optic Handhole (30"x48"x24" Deep)
BHF (30x48x36" Deep)	Buried Fiber Optic Handhole (30"x48"x36" Deep)

A. Fiber Optic Handholes

Handholes shall be compliant with the test provisions of ANSI/SCTE 77: Specification for Underground Enclosure Integrity and shall be rated for AASHTO Tier 22 loading when installed behind a curb or travel way and shall be rated for AASHTO H-20 loading when indicated as such on the plans.

Nominal minimal handhole dimensions shall be as shown on the bid quantities list, unless approved by the Engineer. The larger 30x48 handholes shall have embedded racking which allows the splice case and cable slack coil to be attached to the side of the box, and off the ground inside the box. The box shall also have an open bottom allowing for conduit to enter through the bottom of the box.

B. Fiber Optic Handhole Covers

Handhole covers shall be compliant with the test provisions of ANSI/SCTE 77: Specification for Underground Enclosure Integrity and shall be rated for AASHTO Tier 22 loading when installed behind a curb or travel way and shall be rated for AASHTO H-20 loading when indicated as such on the plans.

Handhole covers shall be equipped with pull slots with a minimum width of 1/2 inch.

Handhole covers shall have four locking bolts on each corner with a washer. Locking bolts can be Hex (9/16 inch) or Penta (7/8 inch).

Handhole covers shall be slip resistant and clearly marked with "CRIT COMMUNICATIONS" and shall be visible to a technician while present at the box to easily identify the ownership of the box.

C. Marking Post

Marking posts shall be plastic or fiber glass material.



Item Number	Item Description
BD5	BD5 Pedestal

A. General Requirements

BD5 pedestals shall be specifically designed for outdoor telecommunications applications and shall be suitable for direct-buried installation in outside plant environments.

Pedestals shall be constructed of high-density polyethylene (HDPE), polymer composite, or Engineer-approved equivalent material resistant to ultraviolet degradation, moisture intrusion, impact loading, corrosion, chemicals, and other environmental conditions commonly encountered in outdoor broadband installations.

Unless otherwise approved by the Engineer, BD5 pedestals shall meet the following minimum requirements:

Item	Requirement
Enclosure Material	HDPE or Polymer Composite
Color	Green or Almond
Installation Type	Direct Buried
Environmental Rating	NEMA 3R Minimum
Operating Temperature	-40°C to +60°C
Wind Load Rating	90-120 mph Minimum
Grounding Provision	Internal Grounding Bar
Internal Mounting	Factory-Installed Brackets for Splice Trays or Terminal Blocks
Cable Storage Capacity	Minimum 100 Feet of Slack Storage
Cover Style	Two-Piece Dome or Hinged Cover
Access Hardware	216 Tool Access or Hex Head Fastener
Compliance Standards	Telcordia GR-13 CORE and RUS PE-91

Pedestals shall include an open-bottom base to accommodate conduit entry and cable routing. Covers shall positively interlock with the pedestal base to resist displacement, uplift, vandalism, and environmental exposure.

All hardware, brackets, fasteners, and grounding components shall be corrosion-resistant and suitable for long-term outdoor service.



Item Number	Item Description
BM2 (5/8)(8)	Ground Rod

A. General Requirements

Ground rods shall be one-piece copper-clad steel rods conforming to UL 467 and shall be a minimum of 5/8 inch in diameter and 8 feet in length. Ground rod clamps shall be bronze or copper alloy and listed for direct burial applications. Grounding conductors shall be bare copper, not less than No. 6 AWG unless otherwise specified. All grounding materials shall be suitable for underground use and resistant to corrosion.



Item Number	Item Description
HBFO (L): BURIED FOSC 450D	Place Large Fiber Optic Splice Closure in Handhole
HBFO (M): BURIED FOSC 450B	Place Medium Fiber Optic Splice Closure in Handhole
HAPO(L): AERIAL FOSC 450D	Aerial Splice Case Size Large
HAPO(M): AERIAL FOSC 450B	Aerial Splice Case Size Medium

A. General Requirements

The splice closures shall be cylindrical, butt-end-style, gel sealed, corrosion resistant, water-tight and meet the requirements of GR-771-CORE, GR-769-CORE and be compatible with the fiber to be installed. Splice closures shall be gel sealed, bonded, anchored, and provide efficient routing, storage, organization and protection for fiber optic cable and splices. The fiber optic splice closure shall be provided with a minimum of two express ports for entry and exit of uncut trunk line cable and a minimum of four additional ports for branch cables. The splice trays shall meet ANSI/EIA/TIA-568, Revision D and TIA-606, Revision C and be compatible with the fiber to be installed.



Item Number	Item Description
V(1)1.25"	Place one 1.25" Conduits
V(2)1.25"	Place two 1.25" Conduits
V(3)1.25"	Place three 1.25" Conduits

A. Fiber Optic Conduit

All conduit and conduit fittings shall be listed by UL and conform to NEC standards. Conduit to be installed shall be either polyvinyl chloride (PVC) rigid nonmetallic type conforming to the requirements of UL 651 for Rigid Nonmetallic Conduit or High-Density Polyethylene (HDPE) conduit. PVC conduit and conduit fittings shall be Schedule 40, heavy wall, manufactured from high impact material and shall be rated for use at 90 degrees C. For HDPE Conduit, the HDPE formulations used by the manufacturer must be specifically intended for conduit applications in accordance with ASTM F2160: Solid Wall High Density Polyethylene Conduit based on controlled outside diameter. The HDPE conduit shall be SDR 11 or better and marked with the ASTM F2160 and UL 651A designation on the outside. It shall have a cell classification of PE334470C (for black conduit) and PE334470E (for colored conduit) in accordance with ASTM 3350: Standard Specification for Polyethylene Pipe and Fittings Materials. The polyethylene base resin shall meet the density requirement and melt index properties described herein. The density shall not be less than 0.940 and not more than 0.955 g/CM³ in accordance with ASTM D 1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique. The range for the melt index shall be between 0.05 to 0.5g/10 minutes in accordance with ASTM D 1238: Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer. The HDPE conduit shall have a minimum Flexural Modulus, of 80,000 psi, in accordance with ASTM D 790 and a minimum tensile strength at yield of 3,000 psi, in accordance with ASTM D-638. Additives to the base resin shall be included to provide heat stabilization, oxidation prevention and ultraviolet (UV) protection. It shall utilize carbon black in the range of 2 to 3 percent for long-term protection against UV degradation. The minimum protection period shall be two years from date of manufacture in unprotected, outdoor storage conditions. The conduit when installed in a multi-duct configuration shall be of different colors.

Bends used for fiber optic conduit runs shall be at a minimum:

Conduit Size	Min. Radius
2-inch or smaller	24-inch
2½-inch	30-inch
3-inch	36-inch
4-inch	48-inch

B. Fiber Optic Multi-Duct

Multi-duct conduit is described as one of the following:

- A manufactured and connectable system consisting of a pre-assembled outer duct with a predetermined number of innerducts, or



- A manufactured and connectable system consisting of a predetermined number of conduits as shown on the plans with spacers for direct bury without an outer duct.

The innerducts shall be HDPE conduit with a Standard Dimensional Ratio (SDR) of 11 or better. Innerducts shall be fabricated using HDPE or Schedule 40 PVC for straight sections, and HDPE for bends. Innerducts shall contain, or be factory treated with, a friction reducing material that is dry-to-the-touch. Innerducts shall meet the requirements of Telcordia GR-356-CORE (also known as Bellcore GR-356). Bends used for fiber optic multi-duct runs shall be at a minimum of the manufacturer recommended minimum bend radius.

C. Conduit and Innerduct Plugs

Conduit plugs, caps, or sealing fittings for sealing empty conduit and occupied conduit shall be durable, easily removable, reusable, and produce a watertight seal. Plugs, caps, and sealing fittings shall be designed for the diameter of the conduit and cable, shall cause no damage to the cable when installed, and shall have a rope tie on the inside end for connection of a pull rope. Plugs, caps, or sealing fittings used for fiber optic conduit shall provide a watertight and airtight seal of at least 20 psi. Plugs that seal conduits containing fiber optic cable shall be of the 'split' type to allow installation and removal around in-place cables. Plugs, caps, or sealing fittings shall be approved by the Engineer.

D. Fiber Optic Conduit Warning Tape

Fiber optic conduit warning tape shall be a four (4) mil inert plastic film specially formulated for prolonged use underground and shall be a minimum of 3 inches wide. All tape shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Tape shall have a continuous printed message warning that will bear the words "CAUTION FIBER OPTIC" in black letters on an orange background, or approved equivalent. Fiber optic conduit warning tape shall connect into handholes.

E. Pull Tape and Tracer Wire

Only one of the 1 ¼ inch ducts from the duct banks shall be installed with pull tape with a minimum pulling capacity of 2500 lbs. Only one #12 AWG Green tracer wire shall be installed in the ducts. Both the #12 AWG Green tracer wire and the pull tape shall be installed the same duct. The other ducts shall be left empty for future use. Pull tape shall be NETPCO MULETAPE WP2500P or approved equal.

All conduit materials shall be accompanied by warning tape, pull tape, and tracer wire and indicated above.



Item Number	Item Description
PON Cabinet (96-Port)	96-Port PON Cabinet
PON Cabinet (144-Port)	144-Port PON Cabinet

A. General Requirements

The PON cabinet shall be constructed of stainless steel or power-coated aluminum suitable for OSP environments. The exterior shall be powder-coated for corrosion resistance and shall be almond or green for outdoor aesthetics, or approved equal. The cabinet shall be installed with a grounding bar and internal mounting frame for splitters and other distribution modules. The cabinet shall be vault mounted and have an open bottom for conduit access. The base of the cabinet shall provide space for a large splice kit and a minimum of 300 feet of cable slack.

The cabinet shall comply with Telcordia GR-487 CORE (outdoor enclosures), Telcordia GR-20 (fiber cable management), and RUS PE-90 / PE-91 (OSP cabinets and pedestals). Cabinets shall be UV protected for long term outdoor exposure and shall adhere to an operating temperature between -40 degrees Celsius to +65 degrees Celsius. The cabinet shall withstand wind loading between 90-120 mph and shall be NEMA 3R weather resistant.

The PON cabinet shall have a minimum port density of 144 distribution ports for a 144-port cabinet and 96 distribution ports for a 96-port cabinet and up to 12 feeder ports for each type of cabinet. The cabinet shall be able to support a minimum of five 1:32 splitters for 144-port and minimum of three 1:32 splitters for 96-port with the associated number of 12-port polimod cassettes (one for feeder and the remaining for distribution based on port density). Polimod cassettes shall be SC/APC style connectors as approved by the Engineer. Cassettes shall have the minimum capacity of 12 splices per cassette. The cabinet shall have minimum 30 mm bend-radius protection throughout with stainless steel or composite cable retention brackets.

The cabinet shall have a dual-door access (feeder side and distribution side) with telco-standard 216-tool access hardware. Cabinets shall have gasketed doors for weather sealing.



Item Number	Item Description
Telecommunications Optical Broadband Cabinet	Telecommunications Optical Broadband Cabinet

A. General Requirements

The Cabinet shall be new, heavy-duty, outdoor-rated, and listed by a nationally recognized testing laboratory (UL/cUL or equivalent). The Cabinet dimensions will vary in size but will generally be 60" x 40" x 36" depth, with a battery backup compartment. The cabinet shall be UV-resistant, powder-coated aluminum or stainless steel with an off-white powder, corrosion resistant finish suitable for outdoor environments. The cabinet shall comply with GR-487 for outdoor cabinet performance, shall be rated NEMA 3R, and shall meet UL508A requirements for industrial control panels. The cabinet enclosure shall also comply with UL50 and UL50E requirements for enclosure construction and environmental enclosure performance.

The cabinet shall provide front and rear access doors. Doors shall be capable of securing with paddle locks. Door hardware, hinges, latching, and exterior fasteners shall be corrosion-resistant and suitable for outdoor service. Door open and door close alarm contacts shall be provided.

The cabinet shall provide a sealed internal electronics environment. External air and humidity shall be isolated from the internal electronics compartment. Environmental controls shall include a door-mounted air-to-air heat exchanger and/or air conditioner. Cooling capacity shall be a minimum equivalent of a 1,000-watt heat exchanger or approximately 4,000 BTU air conditioner.

The cabinet shall operate within the following ambient temperature range:

Item	Requirement
Operating temperature range	-40°C to +46°C
Operating temperature range	-40°F to +115°F

The cabinet shall be configured for pad-mounted installation. The cabinet shall include base access, cable entry provisions, fiber routing, fiber slack storage, and sealing provisions suitable for underground conduit-fed installation.

The cabinet shall include two separate, vented battery compartments located under or integrated with the cabinet. Battery compartments shall provide front access and shall be capable of securing with paddle locks.

The cabinet shall include a 19-inch vertical equipment rack with a minimum of 20 RU usable rack space. Rack space shall be suitable for installation of active electronics, DC power equipment, fiber management components, and related telecommunications equipment.

AC Power Requirements

The cabinet shall be configured for 240 VAC single-phase input power, 50/60 Hz. The AC load center shall be external to the main equipment compartment. Surge protection shall be provided by a layered surge protective device system using Type 1, Type 2, and point-of-use protection. Surge protection shall use hybrid surge-clamping technologies sized for the available fault current and surge exposure at the cabinet location.



The cabinet shall include an external generator port for portable generator connection. The generator interface shall not require opening the main equipment compartment.
One duplex 15-amp convenience outlet shall be provided inside the cabinet.

DC Power System

The cabinet shall include a -48 VDC rectifier system. The rectifier system shall be 2RU and equipped with dual 1,000-watt rectifier modules.

The DC power system shall include a controller providing system monitoring, alarming, and battery management.

Battery System

The cabinet shall include one battery string consisting of four sealed, maintenance-free VRLA AGM batteries.

Battery Requirement	Minimum Requirement
Battery quantity	Four batteries
Battery type	VRLA AGM
Nominal battery voltage	12 VDC each
System configuration	Series connection for 48 VDC system
Capacity	Approximately 170 Ah at 20-hour rate
Service type	Float / standby service
Electrolyte	Non-spillable AGM
Case	Flame-retardant
Terminals	Bolted terminals
Design life	Approximately 10 years at 77°F / 25°C under float conditions

Batteries shall be suitable for outdoor cabinet installation and standby telecommunications service.

Fiber Management and Distribution

The cabinet shall include integrated fiber routing, fiber slack storage, splice management, and fiber distribution hardware. The cabinet shall have a fiber distribution capacity of 576 high-density cassette SC/APC ports.

The cabinet shall be equipped with 288 high-density cassette SC/APC ports spliced to 100 feet of loose-tube, outdoor-rated fiber optic cable. The fiber cable shall be suitable for underground conduit or direct burial applications and shall include integrated mechanical protection for crush resistance and rodent deterrence. Fiber management shall provide controlled routing, bend-radius protection, and organized slack storage for feeder, distribution, and internal cabinet fibers.

Optical Splitters

The cabinet shall support up to eighteen high-density, cabinet-mounted, integrated 1x32 optical splitters with SC/APC connectors. The cabinet shall be equipped with one high-density, cabinet-mounted, integrated 1x32 optical splitter with SC/APC connectors.



Splitters shall be field-installable within the cabinet fiber management area.

The cabinet shall provide space and mounting provisions for rack-mounted Layer 2 and Layer 3 network equipment.



Item Number	Item Description
2 MST 100'	Multi-Port Service Terminal (Two-Port, 100 ft Length)
2 MST 250'	Multi-Port Service Terminal (Two-Port, 250 ft Length)
2 MST 500'	Multi-Port Service Terminal (Two-Port, 500 ft Length)
2 MST 750'	Multi-Port Service Terminal (Two-Port, 750 ft Length)
2 MST 1000'	Multi-Port Service Terminal (Two-Port, 1000 ft Length)
4 MST 100'	Multi-Port Service Terminal (Four-Port, 100 ft Length)
4 MST 250'	Multi-Port Service Terminal (Four-Port, 250 ft Length)
4 MST 500'	Multi-Port Service Terminal (Four-Port, 500 ft Length)
4 MST 750'	Multi-Port Service Terminal (Four-Port, 750 ft Length)
4 MST 1000'	Multi-Port Service Terminal (Four-Port, 1000 ft Length)
6 MST 100'	Multi-Port Service Terminal (Six-Port, 100 ft Length)
6 MST 250'	Multi-Port Service Terminal (Six-Port, 250 ft Length)
6 MST 500'	Multi-Port Service Terminal (Six-Port, 500 ft Length)
6 MST 1000'	Multi-Port Service Terminal (Six-Port, 1000 ft Length)
8 MST 1000'	Multi-Port Service Terminal (Eight-Port, 1000 ft Length)

A. General Requirements



Multi-Port Service Terminals shall be factory-assembled, environmentally sealed, and designed for outdoor aerial, pedestal, handhole, or below-grade installations. MST housings shall be rated for exposure to moisture, dust, ultraviolet radiation, and temperature extremes typically encountered in outside plant environments.

The terminal shall be equipped with the number of service ports indicated on the plans and shall utilize hardened SC/APC compatible connectors designed for plug-and-play service activation. All unused ports shall be provided with manufacturer-supplied weatherproof protective caps.

Integrated fiber distribution cable shall be single-mode optical fiber meeting ITU-T G.652.D or G.657.A1/A2 specifications. Distribution cable shall be factory-terminated to the MST and supplied in the lengths shown on the quantities. The cable end intended for splicing shall be factory prepared and protected with a secure dust-proof cap or protective sealing suitable for installation and transport.

All materials shall be new and approved for deployment within passive optical network systems.

Item Number	Item Description
SNO-SHOE	Aerial Fiber Storage and Expansion Loops

A. General Requirements

Cable storage assemblies shall be manufactured specifically for outside plant fiber optic cable applications and shall be constructed of corrosion-resistant materials suitable for long-term aerial installation.

Snow-shoe assemblies shall be adjustable and capable of accommodating a minimum of 100 feet of fiber optic cable storage. Storage assemblies shall be designed to maintain the minimum cable bend radius specified by the cable manufacturer and shall be capable of supporting cables up to and including 288-fiber loose-tube cable configurations without damage or deformation to the cable jacket.

All brackets, clamps, banding, bolts, nuts, and other mounting hardware shall be galvanized steel, stainless steel, UV-resistant polymer, or other approved corrosion-resistant materials suitable for the installation environment.





Item Number	Item Description
10M STRAND	Attachment 10M Strand to Poles. Includes all necessary hardware.

A. General Requirements

Support strand shall consist of extra-high-strength (EHS) galvanized steel strand meeting ASTM and applicable utility industry standards.

Unless otherwise specified on the plans, support strand shall be a minimum of **3/8-inch, 7-wire strand (10M)** with a minimum rated breaking strength of **10,000 pounds**.

All strand hardware, including suspension clamps, dead-end attachments, strand vises, bonding clamps, grounding connectors, strand links, guy attachments, bolts, washers, and nuts shall be corrosion-resistant and designed for aerial outside plant applications.

All materials shall be new and free from defects and shall be compatible with the support strand and intended installation environment.



Item Number	Item Description
BM82	Build Riser up pole. Includes conduit and riser materials.

A. General Requirements

Riser guards shall be manufactured from high-density polyethylene (HDPE) or other approved UV-resistant, impact-resistant material specifically designed for outside plant telecommunications applications.

Riser guards shall be of sufficient diameter and capacity to accommodate a minimum of four (4) fiber optic cables while maintaining the minimum bend radius requirements specified by the cable manufacturer.

Each riser guard assembly shall include a compatible manufacturer-recommended riser boot or bell-end fitting designed to protect cables entering and exiting the riser guard from abrasion, moisture intrusion, and physical damage.

All mounting straps, clamps, banding, bolts, and associated hardware shall be corrosion-resistant and suitable for long-term outdoor service.



Item Number	Item Description
PE1-3	Down Guy for 10M Strand
PE2-3	Overhead Guy for 10M Strand

A. General Requirements

Down guy and span guy wires shall be constructed of galvanized steel strand. Guy wire size shall be one standard size larger than the supporting messenger strand, with a minimum size of 10M. All guy wires shall have a minimum rated breaking strength of 10,000 pounds.

All hardware, fittings, anchors, and accessories required for a complete installation shall be compatible with the guy wire system and suitable for the intended loading conditions.



Item Number	Item Description
PF1-5	Expanding Anchor (10,000 Pounds)

A. General Requirements

Ground anchors shall be helical, expanding, or utility-approved anchor assemblies as shown on the construction drawings or approved by the pole owner. Anchors shall be rated for a minimum ultimate holding capacity of 10,000 pounds when installed in Class 5 soil.

Anchor rods, nuts, washers, and associated hardware shall be hot-dip galvanized steel and shall be compatible with the installed guying system. All materials shall be new and free of defects.

Where soil conditions differ from those assumed in design, the Contractor shall notify the Engineer and pole owner for review and determination of any required anchor modifications.



Item Number	Item Description
PM11	Guy Guard

A. General Requirements

Guy guards shall be PM11 manufactured split-type guy guards or Engineer-approved equivalent specifically designed for installation on telecommunications and power utility down guy wires. Guy guards shall be manufactured from high-density polyethylene (HDPE) or equivalent UV-stabilized thermoplastic material suitable for long-term outdoor service.

Guy guards shall be yellow in color and shall be resistant to ultraviolet degradation, impact, corrosion, moisture, temperature extremes, and other environmental conditions commonly encountered in outdoor utility installations. The guy guard shall have the following minimum characteristics:

Item	Requirement
Type	PM11 Split-Type Guy Guard
Material	UV-Stabilized HDPE
Color	Safety Yellow
Length	8 feet (96 inches) minimum
Installation	Openable split design
Weather Resistance	UV and moisture resistant
Service Environment	Outdoor utility applications

Attachment hardware shall be stainless steel, aluminum, or other corrosion-resistant materials recommended by the manufacturer. All hardware shall be new and free from defects.



Item Number	Item Description
PM12	Sidewalk Arm Guy Assembly

A. General Requirements

PM12 Sidewalk Arm Guy Assemblies shall be manufactured units specifically designed for utility pole sidewalk applications and shall be approved by the pole owner. Sidewalk arm assemblies shall be hot-dip galvanized steel or equivalent corrosion-resistant material suitable for long-term outdoor service.

The assembly shall be designed to withstand the anticipated guy loads and shall be compatible with the associated guy wire, guy attachment hardware, anchors, and utility pole construction requirements.

The sidewalk arm assembly shall have the following minimum characteristics:

Item	Requirement
Type	PM12 Sidewalk Arm Guy Assembly
Material	Hot-Dip Galvanized Steel
Finish	Corrosion Resistant
Application	Utility Pole Sidewalk Guying
Design Load	Compatible with Guying System Requirements
Mounting	Pole-Mounted Hardware Assembly
Service Environment	Outdoor Utility Applications

All bolts, clamps, brackets, washers, nuts, and attachment hardware shall be galvanized steel, stainless steel, or other pole owner-approved corrosion-resistant materials. All materials shall be new and free of defects.



Item Number	Item Description
GROUND PM2A	Ground Wire Assembly

A. General Requirements

The PM2A Ground Assembly shall consist of a preformed or utility-approved grounding assembly suitable for telecommunications applications. The assembly shall include a minimum No. 6 AWG solid bare copper grounding conductor, grounding clamps, bonding connectors, pole mounting hardware, and associated accessories required to complete the installation.

Grounding hardware shall be manufactured from corrosion-resistant materials suitable for long-term outdoor service and may include:

- Copper
- Tin-plated copper
- Bronze
- Silicon bronze
- Hot-dip galvanized steel
- Aluminum materials approved for grounding applications

Grounding connectors shall be listed and rated for the intended conductor sizes and installation environment.

All materials shall be new and free of defects.

Item	Requirement
Ground Conductor	#6 AWG Solid Bare Copper
Grounding Connectors	Utility Approved
Hardware Material	Corrosion Resistant
Service Environment	Outdoor Utility Applications
Standards	NESC and Applicable Utility Requirements



Item Number	Item Description
Fiber Glass Extension Arm	Fiber Glass Extension Arm to Raise the Fiber

A. General Requirements

Fiberglass extension arms shall be utility-grade assemblies specifically designed for pole-mounted telecommunications and broadband applications.

Unless otherwise shown on the plans, fiberglass extension arms shall have the following minimum characteristics:

Item	Requirement
Type	Fiberglass Extension Arm
Length	12 inches
Offset Angle	15 Degrees
Rod Diameter	1.5 inches
Arm Material	Fiberglass Reinforced Polymer (FRP)
Coating	MPS Gray UV-Protective Coating
Base Material	Ductile Iron, Hot-Dip Galvanized
End Fitting Material	Aluminum
Mounting Hardware	Accepts 5/8-Inch Through Bolts
End Fitting Studs	5/8-Inch × 2-Inch with Anti-Rotation Cleats
Minimum Vertical Ultimate Load Rating	1,200 lbs
Minimum Horizontal Ultimate Load Rating	1,500 lbs
Minimum Longitudinal Ultimate Load Rating	1,200 lbs
Service Environment	Outdoor Utility Applications

All mounting brackets, bolts, nuts, washers, and attachment hardware shall be hot-dip galvanized steel, stainless steel, or other pole owner-approved corrosion-resistant materials. Materials shall be new, free from defects, and suitable for long-term outdoor use.



Item Number	Item Description
NID	Network Interface Device at the Premise

A. General Requirements

Network Interface Devices shall be specifically designed for outdoor fiber optic applications and shall be suitable for installation on residential, commercial, tribal, and institutional buildings.

Unless otherwise approved by the Engineer, NIDs shall meet the following minimum requirements:

Item	Requirement
Enclosure Material	UV-Resistant ABS, Polycarbonate (PC), or Equivalent Thermoplastic
Color	Light Gray or Neutral Tone
Approximate Size	10 in. × 8 in. × 2 in. Minimum or Engineer-Approved Equivalent
Environmental Rating	Outdoor Weather Resistant
Operating Temperature	-40°C to +80°C
Fiber Entry Ports	Minimum Two (2)
Conduit Capacity	Up to 1-Inch Conduit Per Entry Port
Port Sealing	Weather-Tight Grommets or Equivalent
Fiber Storage Capacity	Minimum 50 Feet Slack Storage
Adapter Types	SC/APC, SC/UPC, LC, or Engineer-Approved Equivalent
Service Application	FTTH and Broadband Networks

The enclosure shall be resistant to ultraviolet degradation, moisture intrusion, rain, dust, corrosion, insects, and other environmental conditions commonly encountered in outdoor installations.

The NID shall include provisions for securing incoming OSP fiber cables and outgoing customer service fibers, as well as integrated cable management features to maintain minimum fiber bend radius requirements.

All adapters, couplers, pigtails, jumpers, splice trays, mounting hardware, seals, and accessories shall be new, compatible with the installed fiber optic network, and free from defects.



Item Number	Item Description
1:32 splitter	1:32 Splitter
1:64 splitter	1:64 Splitter

A. General Requirements

Fiber optic splitters shall be planar lightwave circuit (PLC) type splitters designed for outdoor telecommunications and broadband network applications. Unless otherwise shown on the plans, splitters shall be either 1x32 (one input, thirty-two outputs) or 1x64 (one input, sixty-four outputs) and shall be compatible with the installed PON cabinet, fiber distribution equipment, and XGS-PON network electronics.

Splitters shall meet the following minimum requirements:

Item	Requirement
Splitter Type	Planar Lightwave Circuit (PLC)
Split Ratio	1x32 or 1x64
Fiber Type	Single-Mode Fiber (ITU-T G.652.D or G.657.A1/A2 Compatible)
Connector Type	SC/APC Preferred; LC/APC or Engineer-Approved Equivalent
Pigtail Length	1.0 to 1.5 Meters
Operating Wavelength Range	1260 to 1650 nm
Network Compatibility	GPON, XGS-PON, and Future PON Upgrades
Mounting Method	Rack Mount, Panel Mount, or Cabinet Sidewall Mount
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Compliance Standards	Telcordia GR-1209 and GR-1221

Minimum optical performance requirements shall be as follows:

Parameter	Requirement
Insertion Loss (1x32 Typical)	≤ 17.5 dB with connectors
Insertion Loss (1x64 Typical)	≤ 20.5 dB with connectors
Premium Grade Insertion Loss (1x64)	≤ 19.3 dB with connectors
Loss Uniformity	≤ 2.0 dB
Return Loss (SC/APC)	≥ 55 dB
Polarization Dependent Loss (PDL)	≤ 0.4 dB
Directivity	≥ 55 dB
Wavelength Dependent Loss	≤ 0.5 dB

All splitter assemblies shall be factory tested and supplied with manufacturer documentation demonstrating compliance with the specified performance requirements.