

SECTION 27 11 00  
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION **NOTE: BACKBONE CABLING ~~IS~~ SHALL BE DELETED AS PART OF ALTERNATE 4.**

**MASS NOTIFICATION AND PA CABLING ~~IS~~ SHALL BE DELETED AS PART OF ALTERNATE 4.**

**HORIZONTAL VOICE AND DATA CABLING, RACK MOUNTED EQUIPMENT INCLUDING PATCH PANELS, FIBER TERMINATION PANELS, HORIZONTAL CABLE MANAGERS, UPS'S, ETC ARE NOT IN CONTRACT-N.I.C.**

- A. This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "*the System*"), and associated equipment and hardware to be installed in the VA-1A Building here-in-after referred to as "*the Facility*". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, "patch" cables, and/or "break out" devices.
- B. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- D. The Voice and Digital Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System which is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum , the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health Care Organization (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

E. The VA Project Manager (PM) and/or if delegated, Resident Engineer (RE) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

F. System Performance:

1. At a minimum, the System shall be able to support the following voice and data operations for Category 6 Certified Telecommunication Service:

a. Provide the following interchange (or interface) capabilities:

- 1) Basic Rate (BRI).
- 2) Primary Rate (PRI).

b. ISDN.

1) Narrow Band BRI:

- a) B Channel: 64 kilo-Bits per second (kBps), minimum.
- b) D Channel: 16 kBps, minimum.
- c) H Channel: 384 kBps, minimum.

2) Narrow Band PRI:

- a) B Channel: 64 kBps, minimum.
- b) D Channel: 64 kBps, minimum.
- c) H Channel: 1,920 kBps, minimum.

3) Wide (or Broad) Band: All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at "T" reference.

c. ATM operation and interface: ATM 155 mBps.

d. Frame Relay.

e. Integrated Data Communications Utility (IDCU) operation and interface.

f. Government Open Systems Interconnection Profile (GOSSIP) compliant.

g. Fiberoptic Distributed Data Interface (FDDI).

h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data locations.

2. At a minimum the System shall support the following operating parameters:

a. EPBX connection:

- 1) System speed: 1.0 gBps per second, minimum.
- 2) Impedance: 600 Ohms.
- 3) Cross Modulation: -60 deci-Bel (dB).
- 4) Hum Modulation: -55 dB.
- 5) System data error: 10 to the -10 Bps, minimum.
- 6) Loss: Measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.
  - a) Trunk to station: 1.5 dB, maximum.
  - b) Station to station: 3.0 dB, maximum.
  - c) Internal switch crosstalk: -60 dB when a signal of + 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.
  - d) Idle channel noise: 25 dBm "C" or 3.0 dBm "O" above reference (terminated) ground noise, whichever is greater.
- e) Traffic Grade of Service for Voice and Data:
  - (1) A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic

overload in the data circuits will not interfere with, or degrade, the voice service.

(2) Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

## 1.2 RELATED WORK

- A. Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Specification Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- D. Specification Section 27 10 00, STRUCTURED CABLING.
- E. Specification Section 26 27 26, WIRING DEVICES.
- F. Specification Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- G. Specification Section 26 41 00, FACILITY LIGHTNING PROTECTION. N.I.C.
- H. Specification Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS.
- I. H-088-C3, VA HANDBOOK DESIGN FOR TELEPHONE SYSTEMS.

## 1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.
- B. National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

- C. Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

- D. ANSI/EIA/TIA Publications:

568B	Commercial Building Telecommunications Wiring Standard
569B	Commercial Building Standard for

	Telecommunications Pathways and Spaces
606A	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

- E. Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".
- F. International Telecommunication Union - Telecommunication Standardization Sector (ITU-T).
- G. Federal Information Processing Standards (FIPS) Publications.
- H. Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.
- I. United States Air Force: Technical Order 33K-1-100 Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.
- J. Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals.
- K. National and/or Government Life Safety Code(s): The more stringent of each listed code.

#### **1.4 QUALITY ASSURANCE**

- A. The authorized representative of the OEM, shall be responsible for the design, satisfactory total operation of the System, and its certification.
- B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.
- C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor's Technical Submittal.
- D. All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.
- E. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

### 1.5 SUBMITTALS

- A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The RE shall retain one copy for review and approval.
  - 1. If the submittal is approved the RE shall retain one copy for Official Records and return three (3) copies to the Contractor.
  - 2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.
- B. Environmental Requirements: Technical submittals shall confirm the environmental specifications for physical TC areas occupied by the System. These environmental specifications shall identify the requirements for initial and expanded system configurations for:
  - 1. Floor loading for batteries and cabinets.
  - 2. Minimum floor space and ceiling heights.
  - 3. Minimum size of doors for equipment passage.
  - 4. Power requirements: The Contractor shall provide the specific voltage, amperage, phases, and quantities of circuits required.
  - 5. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
  - 6. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
  - 7. Proposed floor plan, based on the expanded system configuration of the bidder's proposed EPBX for this FACILITY.
  - 8. Conduit size requirement (between main TC, computer, and console rooms).
  - 9. Main trunk line and riser pathways, cable duct, and conduit requirements between each MTC, TC, and TCO.
- C. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:
  - 1. Title page to include:
    - a. VA Medical Center.
    - b. Contractor's name, address, and telephone (including FAX) numbers.
    - c. Date of Submittal.
    - d. VA Project No.
  - 2. List containing a minimum of three locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
    - a. Installation Location and Name.
    - b. Owner's or User's name, address, and telephone (including FAX) numbers.
    - c. Date of Project Start and Date of Final Acceptance by Owner.
    - d. System Project Number.
    - e. Brief (three paragraphs minimum) description of each system's function, operation, and installation.
  - 3. Narrative Description of the system.
  - 4. A List of the equipment to be furnished. The quantity, make, and model number of each item is required.
  - 5. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

6. Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.
  7. Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.
- D. Test Equipment List:
1. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.
  2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
    - a. Spectrum Analyzer.
    - b. Signal Level Meter.
    - c. Volt-Ohm Meter.
    - d. Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
    - e. Bit Error Test Set (BERT).
- E. Samples: A sample of each of the following items shall be furnished to the RE for approval prior to installation.
1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
    - a. One each telephone (or voice) rj45 jack installed.
    - b. Two each multi pin data rj45 jacks installed.
    - c. Cover Plate installed.
  2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
  3. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
  4. Fiber optic CCS patch panel or breakout box with cable management equipment and "LC" connectors installed.
  5. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  6. 610 mm (2 ft.) section of each fiber optic cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
- F. Certifications:
1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
  2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
  3. Preacceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.

- G. Equipment Manuals: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the RE. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.
- H. Record Wiring Diagrams:
1. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the RE. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.
  2. The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The RE shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.

## **PART 2 - PRODUCTS**

### **2.1 2-POST OPEN EQUIPMENT RACKS (45RU)**

- A. Floor mounted racks shall meet the following physical specifications
1. UL Listed.
  2. Lightweight aluminum construction with black finish.
  3. 19" rack mounting space, 84" high.
  4. 15" deep x 20.25" wide base with four (4) ¾" bolt down holes.
  5. 3" deep channel side rails with double-sided tapped holes. Tapped holes shall conform to the standard EIA/TIA hole pattern.
  6. Provide 50 Phillips head equipment mounting screws with each rack.
  7. Provide a ground termination bracket with each rack to enable connection of a 2 hole grounding lug.
- B. Acceptable Products
1. Chatsworth Enhanced Standard Rack (Chatsworth p/n 55053-703).
  2. Cooper B-Line p/n SB556084XUFB.
  3. Or equal.
- C. Provide base dust cover for each rack:
1. Acceptable Products:
    - a. Chatsworth p/n 41050-719.
    - b. Cooper B-Line p/n SB59501AFB.
    - c. Or equal.
- D. Provide rack grounding kit with each rack:
1. Acceptable Products:
    - a. Rack Grounding Kit (Chatsworth p/n 40167-001).
    - b. Or equal.

### **2.2 CONCRETE EXPANSION ANCHORS**

- A. Secure equipment racks and cabinets to the concrete floor with a minimum of four (4) 5/8" diameter concrete expansion anchors. Expansion anchors shall be manufactured of carbon steel with zinc plating.
- B. Anchors shall have a minimum concrete embedment depth of 2 ¾" inches.
- C. Expansion anchors shall have a minimum allowable pull out strength of 1,800 lbs and a minimum ultimate pull out strength of 7,000 lbs in 3,000 psi concrete.
1. Acceptable manufacturers
    - a. Hilti.
    - b. Red Head.



c. Or equal.

### **2.3 PLYWOOD BACKBOARDS**

- A. Provide 4'-0" x 8'-0" x 3/4" AC void free plywood. Paint plywood with 2 coats of white fire retardant paint. Plywood shall be secured to the wall with sufficient anchors to support 1,500 lbs of equipment weight.

### **2.4 HORIZONTAL CABLE MANAGEMENT NIC**

- A. Horizontal and vertical cable managers shall be provided from the same manufacturer and shall be compatible with the specified racks.
- B. Horizontal cable managers shall be 2 rack units in height and have hinged front covers. Hinges shall allow covers to be pivoted in 2 directions. See rack elevations for quantity.
- C. All components shall be color black.
  - 1. Acceptable Products:
    - a. Chatsworth p/n 30130-719.
    - b. Cooper B-Line p/n SB87019S2FB.
    - c. Or equal.

### **2.5 VERTICAL CABLE MANAGEMENT FOR FLOOR STANDING RACKS**

- A. Horizontal and vertical cable managers shall be provided from the same manufacturer and shall be compatible with the specified racks.
- B. Provide 6" wide by 84" high vertical cable managers for all racks. See rack elevations for size and quantity:
  - 1. Vertical cable managers shall be bolted to the racks. Where vertical cable managers are located between racks, the vertical managers shall be bolted to both racks.
  - 2. Each vertical cable manager shall provide separate front and rear raceways.
  - 3. Holes shall be provided between the front and rear raceway sections to facilitate cable routing.
  - 4. Vertical cable managers shall have 6" wide x 5.35" deep slotted ducts on the front of the rack and open ring cabling sections on the rear of the rack.
  - 5. Hinged black plastic covers shall be provided on the front of the vertical cable manager to conceal cable after installation.
  - 6. All components shall be color black.
  - 7. Acceptable Products
    - a. Chatsworth CCS Combination Cabling Section p/n 30162-703.
    - b. Cooper B-Line p/n SB86486D084FB.
    - c. Or equal.
- C. Provide (12) fiber management spools within the vertical cable management sections installed on each side of the main fiber rack in the MDF room (6 spools in each vertical section). Attach spools to the 2.5" pass-through holes in the CCS combination cabling section. The top 6 pass-through holes shall be used, leaving the bottom pass-through hole empty.

### **2.6 CATEGORY 6 COPPER PATCH PANELS NIC**

- A. Provide 19" rack mounted 48-port or 24-port Category 6 data patch panels as shown on the drawings.
- B. Patch panels shall be constructed of black anodized aluminum or black powder coated steel.
- C. Patch panels shall have fixed outlet jacks with 110 IDC connectors on the rear of the panel.
- D. Patch panels shall be wired in accordance with the T568B standard.
- E. The same manufacturer will be used for both the patch panels and workstation outlets throughout the Project.



- F. Patch panels shall conform to the performance requirements of ANSI/TIA/EIA-568-B.2 Addendum 1 as shown below.

Parameter	Worst Case Channel Performance at 100MHz
Specified Frequency Range	1-250 MHz
Attenuation	0.2 dB
NEXT	54.0 dB
Return Loss	24.0 dB

- G. Acceptable Products:  
1. Panduit DP48688TGY.  
2. No Substitutions Accepted.

**2.7 WALL MOUNTED CATEGORY 5E 110 BLOCKS**

- A. Provide 100-pair Category 5E wall mounted 110 IDC blocks with plastic stand-off mounting legs for termination of backbone voice cabling at the MDF and IDF's (see drawings for quantity and location).
- B. Provide label kit w/plastic holders.
- C. Provide plastic jumper troughs with stand-off legs at the top, bottom and side of each 100-pair wiring block for routing of cross connect wire.
- D. Completely load 110 blocks with C5 connecting blocks.
- E. Acceptable Products  
1. Belden/CDT 100-Pair Wall Mount Frame Kit P/N AX100694.  
2. Panduit 100-Pair Wall Mount Frame Kit P/N P110KB1005.  
3. Or equal.

**2.8 48-PORT RACK MOUNTED OPTICAL FIBER TERMINATION CABINETS NIC**

- A. Provide 2RU 19" rack mounted optical fiber termination cabinets. See rack elevations for quantity and port density of panels. Fiber termination cabinets shall have a black smoked Plexiglas front cover. Fiber termination cabinets shall have integral cable strain relief clamps.
1. Acceptable Products  
a. Corning LANScape Pretium Connector Housing P/N PCH-02U.  
b. AFL Telecommunications LightLink LANSysystem CON048P P/N FM001029-BE.  
c. Or equal.
- B. Provide quantity of duplex LC singlemode and multimode adapter panels to terminate all backbone fiber optic cabling as shown on the drawings. Provide blank adapter panels as shown on the drawings. Adapter panels shall have factory installed LC connectors with fiber pigtails. Provide quantity of adapter panels and pigtails to terminate all fiber optic cabling. Connectors and pigtails shall match the type of fiber being terminated.
1. Acceptable Products:  
a. 12-Strand 50/125 Laser Optimized MM Fiber Pigtails:  
(1) Premise 12-Strand 50/125 Laser Optimized MM Fiber - Corning LANScape P/N CCH-CP12-E4-P03SH.  
(2) AFL Telecommunications LC Duplex Pigtail PDL-XXX-RC-012-L-0003-N and Plate Adapter FM001302.  
(3) Or equal.  
b. 12-Strand SM Fiber Pigtails:  
(1) Corning LANScape P/N CCH-CP12-A9-P03RH.

- (2) AFL Telecommunications LC Duplex Pigtail UDL-XXX-RC-012-Q-0003-N and Plate Adapter C215993.
  - (3) Or equal.
  - C. Splice trays shall be provided to fusion splice the factory installed pigtails to the backbone fiber optic cable. Splice trays shall accommodate 12 single fiber heat shrink fusion splices. Provide qty of splice trays to terminate all fiber optic cabling.
    - 1. Acceptable Products
      - a. 12 Fiber Splice Tray - Corning LANscape P/N M67-048.
      - b. AFL Telecommunications P/N FM001315.
      - c. Or equal.
  - D. Each fiber optic termination cabinet shall be provided with the following accessories -splice tray brackets, cable strain relief brackets and universal cable clamp strain relief kits.
    - 1. Acceptable Products
      - a. Splice tray brackets - Corning LANscape Pretium P/N PC2-SPLC-6SR (Item already provided with AFL Fiber Termination Cabinets).
      - b. Strain Relief Brackets - Corning LANscape Pretium P/N PC2-STRN (Item already provided with AFL Fiber Termination Cabinets).
      - c. Cable Clamp Kit - Corning LANscape Pretium P/N UCC-001 (Item already provided with AFL Fiber Termination Cabinets).
      - d. Or equal.
- 2.9 144-PORT RACK MOUNTED OPTICAL FIBER TERMINATION CABINETS NIC**
- A. Provide 4RU 19" rack mounted optical fiber termination cabinets. See rack elevations for quantity and port density of panels. Fiber termination cabinets shall have a black smoked Plexiglas front cover. Fiber termination cabinets shall have integral cable strain relief clamps.
    - 1. Acceptable Products
      - a. Corning LANscape Pretium Connector Housing P/N PCH-04U.
      - b. AFL Telecommunications XFM 4RU Patch Panel P/N FM001090-B.
      - c. Or equal.
  - B. Provide quantity of duplex LC singlemode and multimode adapter panels to terminate all backbone fiber optic cabling as shown on the drawings. Provide blank adapter panels as shown on the drawings. Adapter panels shall have factory installed LC connectors with fiber pigtails. Provide quantity of adapter panels and pigtails to terminate all fiber optic cabling. Connectors and pigtails shall match the type of fiber being terminated.
    - 1. Acceptable Products
      - a. 12-Strand 50/125 Laser Optimized MM Fiber Pigtails:
        - (1) Premise 12-Strand 50/125 Laser Optimized MM Fiber - Corning LANscape P/N CCH-CP12-E4-P03SH.
        - (2) AFL Telecommunications LightLink Pigtailed Optical LightLink Interconnect Module P/N FM001363.
        - (3) Or equal.
      - b. 12-Strand SM Fiber Pigtails:
        - (1) Corning LANscape P/N CCH-CP12-A9-P03RH.
        - (2) AFL Telecommunications LightLink Pigtailed Optical LightLink Interconnect Module P/N FM000750.
        - (3) Or equal.
  - C. Splice trays shall be provided to fusion splice the factory installed pigtails to the backbone fiber optic cable. Splice trays shall

accommodate 12 single fiber heat shrink fusion splices. Provide qty of splice trays to terminate all fiber optic cabling.

1. Acceptable Products
  - a. 12 Fiber Splice Tray - Corning LANscape P/N M67-048.
  - b. AFL Telecommunications (Note: item already included with AFL Fiber Termination Cabinets).
  - c. Or equal.

- D. Each fiber optic termination cabinet shall be provided with the following accessories -splice tray brackets, cable strain relief brackets and universal cable clamp strain relief kits.

1. Acceptable Products
  - a. Splice tray brackets - Corning LANscape Pretium P/N PC4-SPLC-12SR (Item already provided with AFL Fiber Termination Cabinets).
  - b. Strain Relief Brackets - Corning LANscape Pretium P/N PC4-STRN (Item already provided with AFL Fiber Termination Cabinets) .
  - c. Cable Clamp Kit - Corning LANscape Pretium P/N UCC-001 (Item already provided with AFL Fiber Termination Cabinets).
  - d. Or equal.

#### **2.10 WALL MOUNTED "RE-CLOSEABLE" STORAGE RINGS FOR FIBER OPTIC CABLING**

- A. Provide wall mounted re-closeable storage rings for storage of fiber optic backbone cabling slack.
- B. Install quantity of storage rings to accommodate all backbone fiber optic cabling.
- C. Storage rings shall be 24 inches in diameter with recloseable Velcro loops.
  1. Acceptable Products:
    - a. Leviton P/N 48900-FR.
    - b. Or Approved Equal.

#### **2.11 TELECOM ROOM HORIZONTAL CABLE RUNWAY AND SUPPORTS**

- A. Horizontal cable runway, angle support brackets, butt splices, junction splices, mounting plates, elevation kits, grounding straps, etc. shall be provided by a single manufacturer. Installed system shall be grounded per ANSI/TIA/EIA-607-A.
- B. Provide 12" wide or 18" wide horizontal universal style ladder rack in the telecom rooms where shown on the drawings. Ladder rack will be constructed of welded steel tubing. Stringers will be 1.5" in depth with 1.5" wide cross members spaced at 12" OC. Cable runway shall have a black finish.
  1. Acceptable Products:
    - a. Chatsworth Universal Cable Runway. CPI Part Number 11252-712 and 11252-718.Cooper B-Line p/n SB17T12FB and SB17T18FB.
    - b. Or equal.
- C. Provide 15" radius corner brackets at perpendicular intersections of the cable runway.
  1. Acceptable Products:
    - a. Chatsworth Cable Runway Corner Bracket, 15 Wide (Black). CPI Part Number 11959-715.
    - b. Cooper B-Line SB2104FB.
    - c. Or equal.
- D. Provide qty (2) cable runway radius drops above each vertical cable manager to maintain cable bend radius. Coordinate layout of overhead ladder rack cross members so that radius drops are located directly above vertical cable managers. Where cross members conflict with the

vertical cable managers, cut and remove cross members and replace with removable cross members. Where radius drops are connected to removable cross members, install custom radius drops. All components to have a black finish.

1. Acceptable Products:
  - a. Chatsworth Cable Runway Radius Drop, Cross Member (Black). CPI Part Number 12100-712 (for 12" wide runway) and 12100-718 (for 18" wide runway).
  - b. Chatsworth Removable Cross Member. CPI Part Number 12115-712 (for 12" wide runway) and 12115-718 (for 18" wide runway).
  - c. Chatsworth Custom Radius Drop. CPI Part Number 12100-710 (for 12" wide runway) and 12100-716 (for 18" wide runway).
  - d. Or equal.
- E. Provide steel triangular support brackets to support the horizontal cable runway. Triangular support brackets shall be fastened to the stud wall framing. Spacing of the support brackets shall not exceed 4'-0" on center. Support brackets shall have a load capacity of 100 pounds (for 12" wide runway) and 400 pounds (for 18" runway) and shall have a black finish.
  1. Acceptable Products:
    - a. Chatsworth Triangular Support Bracket, Steel, 12" and 18" Wide (Black). CPI Part Number 11312-712 (12") and 11746-718 (18").
    - b. Cooper B-Line SB21312KFB (12") and SB214A18KFB (18").
    - c. Or equal.
- F. Provide manufacturer's butt-splice connections between continuous sections of horizontal ladder rack.
  1. Acceptable Products:
    - a. Chatsworth Butt Splice Kit 1 1/2" x 3/8" Stringer (Black). CPI Part Number 11301-701.
    - b. Cooper B-Line p/n SB2107FB.
    - c. Or equal.
- G. Provide manufacturer's junction-splice connections at 90 degree intersections of horizontal ladder rack.
  1. Acceptable Products:
    - a. Chatsworth Junction Splice Kit 1 1/2" x 3/8" Stringer (Black). CPI Part Number 11302-701.
    - b. Cooper B-Line SB2101AFB.
    - c. Or equal.
- H. Provide cable runway wall angle supports.
  1. Acceptable Products:
    - a. Chatsworth Wall Angle Support Kit, Cable Runway (Black). CPI Part Number 11421-712 and 11421-718.
    - b. Cooper B-Line SB211312FB and SB211318FB.
    - c. Or equal.
- I. Provide custom cable runway elevation kit to secure the top of the equipment racks to the overhead ladder rack. Provide Qty (1) elevation kit per rack.
  1. Acceptable Products:
    - a. Chatsworth Cable Runway Elevation Kit (Black). CPI Part Number SK-7387-701. 3" Channel Rack-to-Runway Mounting Plate, 18" Wide (Black). CPI Part Number 10595-718.
    - b. Cooper B-Line SB227R6FB with mounting plates SB213312FB / SB213318FB.
    - c. Or equal.

- J. Provide cable runway end closing kit to close unspliced ends of the cable runway.
1. Acceptable Products:
- Chatsworth End Closing Kit, Cable Runway, 12" (Black). CPI Part Number 11700-712.
  - Cooper B-Line SB210512FB and SB210518FB.
  - Or equal.
- K. Provide cable runway ground straps to bond each section of the cable runway system together.
1. Acceptable Products:
- Chatsworth Cable Runway Ground Strap. CPI Part Number 40164-001.
  - Cooper B-Line SB6691x7 ¾.
  - Or equal.
- L. Install plastic dust protectors on exposed threaded rod supports (color black).
1. Acceptable Products:
- Panduit Pan-Wrap split harness wrap.
  - Or approved equal.

#### **2.12VELCRO CABLE TIES NIC**

- A. Provide Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling in the telecom rooms routed on the ladder rack to the patch panels. Install Velcro cable ties at 1'-0" intervals.
- B. Do not exceed qty (50) cables per bundle.
- C. Do not attach cable bundles to the runway with the Velcro cable ties. Do not use plastic tie-wraps.
- D. Acceptable Products
- Panduit HLS-15R6.
  - Leviton 43115-075.
  - Or equal.

#### **2.13CATEGORY 6 COPPER PATCH CORDS NIC**

- A. Provide Category 6 UTP patch cords for interconnection of owner furnished switches and patch panels in all IDF's and the MDF.
- B. Provide one (1) patch cord for each data and voice drop.
- C. Provide patch cords of adequate length to avoid excessive slack or tightness in the cable managers. Patch cords shall be a minimum of 4'-0" and a maximum of 15'-0" in length.
- D. Patch cords should be white, made from stranded conductors and have 8-position RJ-45 style plugs on each end. Patch cords shall be snagless with molded strain relief boots.
- E. Cabling used for patch cords shall be manufactured by the same manufacturer as the horizontal cabling and shall be of the same product line. Cable shall conform to the requirements of ANSI/TIA/EIA-568-B.2 Addendum 1. Electrical characteristics and performance of the patch cables shall be nearly identical to the horizontal cable with exceptions given due to differences between solid and stranded conductors as indicated in the following table.

Frequency (MHz)	Stranded Conductor Cable Insertion Loss (dB)
1	2.4
4	4.5

8	6.4
10	7.1
16	9.1
20	10.2
25	11.4
31.25	12.8
62.5	18.5
100	23.8
200	34.8
250	39.4

- F. Patch cords shall be rated for use as communications cable and shall have the designation "CM" or "CMR" printed on the jacket.
- G. Workstation cords and patch cords shall be identical in construction. See Specification Section 27 15 00 for workstation cord requirements.
- H. Acceptable Products:
  1. Belden/CDT GigaFlex PS6+ Modular Cord P/N AX350044 (4 ft), AX350045 (7 ft), AX350046 (10 ft), AX350047 (15 ft).
  2. CommScope Systimax GigaSPEED XL Modular Cord P/N CPC2282-08F0xx.
  3. Or equal.

#### **2.14 MULTIMODE FIBER OPTIC PATCH CORDS NIC**

- A. Provide duplex MM fiber optic patch cords for interconnection of owner furnished switches and fiber backbone cabling. Polarization of fiber optic patch cords shall comply with ANSI/TIA/EIA - 568-B.1 Section 10.3.3.
- B. Provide fiber optic patch cords of adequate length to avoid excessive slack and tightness in the cable managers. Provide minimum 2-meter and maximum 5-meter fiber patch cords.
- C. Provide one (2) patch cords for every owner furnished switch in the MDF. See rack elevations for quantity of owner furnished switches.
- D. Fiber optic cabling shall comply with the requirements of ANSI/TIA/EIA-568-B.3 and ANSI/TIA/EIA-568-B.3 Addendum 1.
- E. Fiber patch cords shall be manufactured of laser optimized 50/125µm multimode cabling meeting the transmission characteristics of the fiber optic backbone cabling. The manufacturer of the fiber patch cord cabling and the fiber backbone cabling shall be identical.
- F. Fiber patch cord connectors shall be duplex LC-type. Cable jacket shall be orange in color with black lettering.
- G. Acceptable Products:
  1. Corning LANscape P/N 040402R53131XXXF.
  2. AFL Telecommunications P/N UDL-UDL-RZ-002-Q-XXX.
  3. Or Approved Equal.

#### **2.15 RACK MOUNTED 120V UNINTERRUPTIBLE POWER SUPPLIES NIC**

- A. Provide UL listed rack mounted 2200VA uninterruptible power supplies as shown in the telecom rack/cabinet schedule. Uninterruptible power supplies shall meet the following physical specifications:
  1. 2 rack spaces high (2RU).
  2. Output voltage distortion less than 5% at full load.
  3. Output frequency 57 to 63 Hz.
  4. Crest Factor up to 5 to 1.
  5. Output connections: qty (6) NEMA 5-15R, qty (2) NEMA 5-20R.

6. Input connection: NEMA 5-20P (2200VA).
  7. Battery type: Maintenance free sealed leakproof lead acid battery with suspended electrolyte.
  8. 3 Hour typical recharge time.
  9. Computer interface ports, DB-9 RS-232, SmartSlot, USB.
  10. LED status display with load and battery bar graphs and on line, on battery, replace battery and overload indicators.
  11. Audible alarm when on battery and low battery condition.
  12. 480 Joules surge energy rating.
  13. Full time multi-pole noise filtering - meets UL 1449.
  14. 2-Year mfg warranty.
  15. Regulatory approvals: BSMI, CSA, UL 1449, UL 1778, FCC Part 15 Class A.
- B. Provide UPS with adequate cord length to plug into electrical outlets.
1. Acceptable Products
    - a. American Power Conversion Smart UPS SUA2200RM2U (2200VA).
    - b. Or Approved Equal.

#### **2.16 IP MANAGEMENT MODULES FOR UNINTERRUPTABLE POWER SUPPLIES NIC**

- A. Provide IP based management module with each UPS for remote monitoring. Module shall be capable of being accessed by web browsing software. Modules shall be manufactured by and shall be compatible with the UPS's.
1. Modules shall accept RJ-45 10/100 Base-T Ethernet connection.
  2. Module shall accommodate the following network protocols (HTTP, HTTPS, IPv4, IPv6, NTP, SMTP, SNMP v1, SNMP v3, SSH V1, SSH V2, SSL, TCP/IP, Telnet).
  3. Module shall accommodate Radius Authentication.
  4. Acceptable Products:
    - a. American Power Conversion UPS Network Management Card 2 P/N AP9630.
    - b. Or Approved Equal.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Product Delivery, Storage and Handling:
1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
  2. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.
- B. System Installation:
1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the RE and PM.
  2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
  3. The Contractor shall install suitable filters, traps, directional couplers, splitters, TC's, and pads for minimizing interference and



for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data, and lightwave signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.

4. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.
  5. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
  6. All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.
  7. All vertical copper and fiber optic cables shall be terminated so any future changes only requires modifications of the signal closet equipment only.
  8. Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair and lightwave cables carrying telephone and data signals in telephone, data, and lightwave systems.
  9. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.
  10. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.
- C. Conduit and Signal Ducts:
1. Conduit:
    - a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 19 mm (3/4 in.).
    - b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by the RE if requested.) Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
    - c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
    - d. When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the

- specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- e. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.
  - f. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
  - g. Ensure that PA Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
- a. The Contractor shall use existing signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
  - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
  - c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.
- F. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.
1. Wires:
- a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.
  - b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.
2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wirewrap, etc.
3. Line or Microphone Audio: Each connector shall be installed according to the cable or connector OEM's instructions and use the OEM's approved installation tool. Install the connector's to provide and maintain the following audio signal polarity:
- a. XLR type connectors Signal or positive conductor is pin 3; common or neutral conductor is pin 2; ground conductor is pin 1.

- b. Two and 3 conductor 1/4" Signal or positive conductor is tip; neutral or 1/8" phono plugs conductor is ring and ground or shield and jacks conductor is sleeve.
- c. RCA Phono Plugs the Signal or positive conductor is tip; and Jacks neutral or shield conductor is sleeve.
- 4. Speaker Line Audio:
  - a. Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.
  - b. One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.
- G. AC Power: AC power wiring shall be run separately from signal cable.
- H. Grounding:
  - 1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.
    - a. The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.
    - b. Gas protection devices shall be provided as shown on the drawings on all "exposed" outside plant copper cables. The Contractor shall install the gas protection devices at the nearest point of entrance in buildings where protection is required and on the same circuits on the MDF in the telephone switch room.
    - c. Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.
    - d. The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.
  - 2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.
  - 3. Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.

4. Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables, shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

I. Equipment Assembly:

1. Cabinets:

- a. Each enclosure shall be: floor or wall mounted with standard knockout holes for conduit connections or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front locking door); power outlet strip(s), and connector or patch panel(s).
- b. Rack (including freestanding radio relay) mounted equipment shall be installed in the enclosure's equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made. Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws for support. Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure. A color matched blank panel (spacer) of 44 mm (1.75 in.) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation. The enclosure shall be designed for efficient equipment cooling and air ventilation. Each console or cabinet shall be equipped with a quiet fan and nondisposable air filter.
- c. Enclosures and racks shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place. Fifteen inches of front vertical space opening shall be provided for additional equipment.
- d. Signal connector, patch, and bulkhead panels (i.e.: audio, data, control, analog video, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "inputs". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "outputs".
  - 1) Equipment located indoors shall be installed in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
  - 2) Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.
  - 3) All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and provides sufficient room for the doors or access panels to open and close without disturbing the cables.

J. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for voice and data circuits shall be stenciled using laser printers. Handwritten labels are not acceptable.

1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams".
2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams".

### 3.2 TESTS NIC

#### A. Interim Inspection:

1. This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 6 marking of outlets, faceplates, outlet/connectors and patch cords.
2. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
3. The Contractor shall notify the RE, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection date.
4. Results of the interim inspection shall be provided to the RE and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.
5. The RE and/or the PM shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the Systems record documentation.

#### B. Pretesting:

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.
  2. Pretesting Procedure:
    - a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
    - b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:
      - 1) Local Telephone Company Interfaces or Inputs.
      - 2) EPBX interfaces or inputs and outputs.
      - 3) MDF interfaces or inputs and outputs.
      - 4) EPBX output S/NR for each telephone and data channel.
      - 5) Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.
  3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.
- C. Acceptance Test:
1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
- D. Verification Tests:
1. Test the UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.
  2. Multimode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-14A using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.
  3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-7 using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.
- E. Performance Testing:

1. Perform Category 6 tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
  2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-B.3.
- F. Total System Acceptance Test: The Contractor shall perform verification tests for UTP copper cabling system(s) and the multimode and single mode fiber optic cabling system(s) after the complete telecommunication distribution system and workstation outlet are installed.
1. Voice Testing: Connect to the network interface device at the demarcation point. Go off-hook and receive dial tone from the LEC. If a test number is available, place and receive a local, long distance, and FTS telephone call.
  2. Data Testing: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network is achieved.

### **3.3 TRAINING NIC**

- A. Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.
- B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

### **3.4 GUARANTEE PERIOD OF SERVICE**

- A. Contractor's Responsibilities:
  1. The Contractor shall guarantee that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.
  2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.
  3. All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
  4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period:
    - a. Response Time:
      - 1) The RE (or facility Contracting Officer if the facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the guarantee period.
      - 2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.



- 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
  - a) A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
  - b) An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.
- 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.
  - a) If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
  - b) Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the RE or Facility Director. The RE or Facility Contracting Officer shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.
- b. Required on-site visits during the one year guarantee period
  - 1) The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this SPEC.
    - a) The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.
    - b) The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the RE or Facility Contracting Officer and the Contractor.
    - c) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE or Facility Contracting Officer.
  - 2) The Contractor shall provide the RE or Facility Contracting Officer a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:
    - a) Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to RE or Facilities Contracting Officer by

the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance

- b) Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
- 3) The RE or Facility Contracting Officer shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
  - a) The RE or Facility Contracting Officer shall ensure copies of these reports are entered into the System's official acquisition documents.
  - b) The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.
- B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

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