

SECTION 27 31 00
VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT

SPEC WRITER NOTES:

1. Edit this specification section between //____//, to fit project, or delete if not applicable.
2. Contact VA's AHJ, Spectrum Management and COMSEC Service (SMCS 0050P2H3), (202-461-5310), for all technical assistance.
3. Included throughout this specification are references to system's interface capability and various related features. System designer must verify availability of this system and coordinate associated requirements and subsequent interfaces.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies a complete and fully functional emergency voice communication switching and routing equipment and system (hereinafter referred to as the "system") to be installed in the // _____ // facility, (hereinafter referred to as the "facility") that includes an emergency voice and dial processing switch, government accepted equipment cabinets, interface enclosures, radio relay racks, stand-by batteries (UPS), combiners, traps, and filters; interconnection nodes and amplifiers; voice station instruments; auxiliary systems; and passive devices such as: protectors, isolators, splitters, couplers, cable patch, punch down, and cross-connector blocks or devices, cable management items, and associated hardware.
- B. Government defines system as a Critical Service Communication System and is so listed by NFPA. Its installation and operation must adhere to appropriate National, Government, and Local Life Safety and Emergency Communication Support Codes, whichever are more stringent for this facility.

1.2 RELATED WORK

- A. Wiring devices: Section 26 27 26, WIRING DEVICES.
- B. Lightning protection system: Section 26 41 00, FACILITY LIGHTNING PROTECTION.
- C. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

- D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- E. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- F. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.
- G. Voice and data cable distribution system and associated equipment: Section 27 15 00, COMMUNICATIONS STRUCTURED CABLING.
- H. Extension of a voice communication switching and routing system: Section 27 31 31, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT EXTENSION.
- I. Emergency Service Public Address System (PAS) and associated equipment: Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS.

1.3 SUBMITTALS

SPEC WRITER NOTES:

1. Select required equipment items quantities that satisfies the needs of the system and edit between the // - //.
 2. Delete equipment items that are not required.
- A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS submit the following:
 1. Bill of Materials.
 2. System cabinet and each interface cabinet layout drawing, as each is expected to be installed.
 3. Equipment technical literature detailing electrical and technical characteristics of each item of equipment to be furnished.
 4. Engineering drawings of system, showing calculated signal levels at system output, each input and output distribution point, proposed telephone outlet values, and signal level at each telephone outlet multi-pin jack.
 5. List of test equipment.
 - B. Environmental Requirements: Confirm environmental specifications for physical TR areas occupied by system. Identify 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: Provide specific voltage, amperage, phases, and quantities of circuits required.
5. Air Conditioning, Heating, and Humidity Requirements:
 - a. Identify ambient temperature and relative humidity operating ranges required to prevent equipment damage.
 - b. Air conditioning requirements expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards.
6. Proposed floor plan, based on expanded system configuration of proposed system for this facility.
7. Conduit size requirement (between main TR, remote TR, Telephone Equipment Room, MCR and devices).
- C. Submit samples of reports generated by TMS with technical submittal for evaluation of formats and compliance with information field content.
- D. Needs Analysis Report: Provide summary report of the needs analysis conducted per requirements of this section.
- E. Provide current and qualified OEM training certificates and OEM certification for contractor installation, maintenance, and supervisory personnel.
- F. Proof of Performance Test Plan: Provide COR and SMCS 0050P2H3 (202) 461-5310 with a Proof of Performance Test Plan 90 days prior to cut-over of system.
 1. Include tests to demonstrate system's capabilities of providing indicated services.
 2. Use only test equipment accepted by SMCS 0050P2H3 (202) 461-5310 and COR included with acceptance test plan.
 3. Submit test equipment certification verifying calibration within six months of system cut-over.
- G. Closeout Submittals:
 1. Provide two copies of OEM developed training video presentation for evaluation and approval by COR.
 2. Provide spreadsheet with details of the complete record program in memory for associated station assignments.
 3. Provide a written commitment from system equipment OEM to supply parts and on-site engineering support services for one year warranty service (materials and labor).

4. Provide OEM certification allowing, OEM or authorized distributor to fully support contract (initial installation, warranty service for warranty period of the contract).
 - a. System equipment OEM's signatory of certified written commitment must be of an individual who has full authority to obligate OEM to this commitment.
 - b. Include names, corporate addresses, and telephone numbers of individuals who have this authority as a part of the commitment.

H. Maintenance Material Submittals:

1. Furnish 5 percent spare protectors for lightning protection system.
2. Furnish one spare audio monitor panel.
3. Furnish on spare electrical supervision panel.
4. Furnish a complete set of system electronic modules and cards to be used as on-hand operational emergency spare equipment. One each of T-1, DS-**, interface cards etc. is the minimum required or a compliment as directed by OEM. Confer with SMCS 0050P2H3 to determine other spare items required to equip system with emergency repair capabilities that completely adhere to system warranty requirements.

1.4 QUALITY ASSURANCE

A. Supervision:

1. Provide a full time on-site project manager, effective on issuance of notice to proceed, responsible to coordinate and supervise contractor and sub-contractor personnel in all phases of installation, training, inspection, cutover, and final acceptance of system. Deliver project manager a complete copy of these specifications to include all amendments prior to start of installation.
2. Coordinate and conduct system data base survey with SMCS 0050P2H3, (202) 461-5310, COR and a member of IT Service identifying all programming of features, classes of service, and equipment installed by type and physical location as specified in this document and all attachments thereto. After survey is completed, turn over a complete list of equipment to COR for approval by SMCS 0050P2H3, (202) 461-5310, prior to start of installation.
3. Ensure that project manager and skilled personnel remain on premise until items on the punch list, developed during inspection, cut-

over, and acceptance testing of system are completed, inspected, and accepted by COR.

4. Be responsible for any and all coordination with LEC relative to interface with commercial telephone system; be responsible for removal of voice and data equipment and cabling abandoned by LEC, Government, or other organizations and not retained for exclusive use by Government as a result of this installation.

B. Needs Analysis (required for replacement of existing systems): Conduct a needs analysis of existing facility with representatives from IRM and various departments to determine system's requirements. Depict system features and capacities, in addition to specific site requirements.

1. System:

ITEM WIRED	EQUIPPED CAPACITY	WIRED CAPACITY
Main Station Lines:		
Single Line		
Multi Line (Equipped for direct inward dialing)		
Central Office Trunks:		
Two Way		
DID		
Two-way Dial Repeating Tie Line		
Foreign Exchange (FX)		
Conference		
Audio Paging Access		
Off-Premise Extensions		
CO Trunk By-Pass		
Monitors w/keyboard(s)		
Printer(s)		
Operator Console(s)		
T-1 Access/Equipment		
Maintenance Terminal		

2. Projected Maximum Growth: Identify projected maximum growth for each item identified in this section. For this purpose, the following definitions are provided to detail system's capability:

- a. Provide software and hardware required to equip system with items listed under equipped capacity, 30 days prior to system cut-over.

- b. Wired Capacity to include wiring and equipment listed under wired capacity, with the exception of line, data, and trunk cards, provided and tested 30 days prior to system cutover.
 - c. Expand system to projected maximum growth through use of printed circuit boards and modular cabinets that do not require extensive re-wiring and reprogramming.
3. Cable Distribution System: Refer to Section 27 15 00, COMMUNICATIONS STRUCTURED CABLING, for specific cable distribution system requirements. Contractor is required to formulate a projected cable and TCO count that coincides with projected maximum growth described herein.
 4. Telephone Instruments (Stations): Telephone instruments are an integral component of system. Indicate each instrument location, type of instrument and class of service as determined by the needs analysis // or as shown on drawings //.

1.5 WARRANTY

- A. Work subject to terms of Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Conform to CFM OI&T Design Guide.
- B. Conform to CFM Electrical Design Manual (EDM-PG18-10, current edition).

SPEC WRITER NOTES:

1. Confer with respective Chiefs of Police, FMS, IT and Engineering Services; AND, technical assistance and approval from VA SMCS 0050P2H3, (202) 461-5310 in order to select and insert the following paragraph(s) required by system design. At least one or more of these paragraphs must be used to ensure patient data access from each patient bed location.
 2. Edit between // _____ // as required.
- C. Perform the following minimum services designed in accordance with and supported by OEM:
 1. Provide continuous inter- and intra-facility voice service.
 2. Capacity size and install systems so that loss of connectivity to an external telephone systems, VoIP and facility's LAN/WAN systems does not affect facility's operation in specific designated emergency operating locations and instruments - including the Commission and NFPA 101 listed Analog Emergency By-Pass Phones; Police Emergency

- Call Equipment (elevator cabs, parking lots, stairwells, Duress Alarms and Locator); Code Blue (One, FAX, Patient Phones).
3. Inter-operate, connect, and function fully with existing Local (Telephone) Exchange Company (LEC) Networks, Federal Telephone Service (FTS) Inter-city Networks, Inter-exchange Carriers, Integrated Services Digital Network (ISDN) and Voice over Internet Protocol (VoIP) at a minimum (NOTE: VoIP Service is not allowed to perform Facility Safety of Life Functions as well as facility's LAN/WAN. Contact SMCS 0050P2H3, (202) 461-5310 for specific technical assistance and approvals.
 4. Contain control and switching equipment, voice and digital system, with attendant consoles.
 5. Contain voice mail and automatic attendant functions and continuous intra- and inter-facility voice service.
 6. Provide universal night answering function from facility designated remote locations.
 7. Direct access to trunk level equipment including audio paging, Industry Standard "T" and "DS" carrier protocols, and external protocol converters.
 8. Provide connections to "T" and "DS" access/equipment or Customer Service Units (CSU or DTE) used in Federal telephone service and other trunk applications. Provide T-1 equipment required to terminate and make operational the quantity of circuits designated. Connect CSUs to system's emergency battery power supply. Provide system capable of operating in industry standard DS protocol and provide that level of service when required.
 9. Contain attendant and operator consoles, video monitors with keyboards, and printers to provide employee directory access from Traffic Management System (TMS). Provide identical capabilities at console positions, video monitors, and keyboards. Provide attendant consoles accepting a mixture of trunk types and extend calls received via these trunks to station users.
 10. Be capable of interfacing and operating with Direct-Incoming-Dial (DID) service to stations as identified herein without affecting intra-facility operation. Provide DID trunk group that must operate as a separate trunk group from other Central Office (CO) trunks.
 11. Contain the designated number of telephone instruments, where each instrument (also referred to as "station") has ability to direct

- dial other facility telephone stations, public telephone network, tie-lines, and FTS telephone numbers without attendant assistance. Provide dual tone multi-frequency (DTMF) for intra-facility and external-facility calling at each station. The term DTMF, as used herein, is defined as "a dialing or analog operation".
12. Provide standard digital // VoIP // telephone instruments at designated TCOs.
 13. Provide at designated TCOs and locations shown on drawings, "Special Hands Free" digital // VoIP // telephone instruments.
 14. Receive specified telephone signals acquired from LEC and FTS contracted carrier, process and distribute them to designated telephone stations, as determined by Class of Service (CoS).
 15. At a minimum, provide four // or _____ // TCOs on each TER //, MCR//, and TR// wall and on either side of each door opening.
 16. Interface and connect telephone multi-pin jack to system via 110 type punch blocks in TER //, MCR//, and TR// meeting Category 5E level of service.
 17. Perform adjacent channel operation a minimum of local, long distance, and Federal telephone service telephone signals. Install and interface system equipment according to OEM's schematic diagram for adjacent telephone channel operation. Provide testing capability in each equipment cabinet, rack, interface point and test ports that provide access for each telephone channel without need to disconnect distribution cables or equipment. Process each telephone channel as a single channel. Include a means of monitoring complete system with appropriate printout and archiving of each processed and distributed channel.
 18. Design system to minimize cross talk, background processor noise, inter-modulation, and other signal interference. Install and interface system equipment according to OEM head-end schematic diagram for adjacent audio channel operation. Process each audio input channel as a single separate channel and combine into one output channel. Provide, in the telephone switch room, an audio and visual monitoring panel to test each converted audio input and distribution channel and analog channels, transmitted and received signal functions. Electrically supervise system's Alternating Current (AC) power input, stand by batteries and charger, internal Direct Current (DC) power supply primary voltages and currents; and

- each remote control unit, audio //, and analog RF// interface unit, from TER. Provide in TER, telephone operator room, MCR, Police Security Service Control Console //, MAS Emergency Room, //, and _____// to check supervisory signals, signal level, audio sound and visual level, and alert personnel to problems.
19. //Provide Digital Signal Processor Resources for a non-blocking telephone system.//
 20. Point Of Local (Telephone) Exchange Company Demarc: Notify COR if signals at LEC interface point do not meet minimum signal level and quality, detailing the nature of the deficiencies, and expected effect on the telephone signals in the new system.
 21. System must acquire telephone signals at // _____ //.
 22. A minimum of // _____ // analog emergency telephone connections must be acquired at // _____ // and connected to // _____ // analog back up circuits.
 23. System Location Selection: Locate system cabinets and associated equipment in the building //_____// floor.
- D. System Performance:
1. Support and fully operate in the following functional modes:
 - a. ISDN Integrated Services for Digital Networks:
 - 1) Basic Rate Interface (BRI).
 - 2) Primary Rate Interface (PRI).
 - b. Fiber-optic Distributed Data Interface (FDDI).
 2. System Sensitivity: Provided satisfactory service for at least 3,000 feet for all voice locations.
 3. //Other _____ //
 4. Minimum System Operating Parameters:
 - a. System Speed: Minimum 1.0 giga-Bits (gb) per second.
 - b. Impedance: 600 Ohms, BAL.
 - c. Cross Modulation: -60 deci-Bel (dB).
 - d. Hum Modulation: -55 dB.
 - e. System Data Error: Minimum 10 to the -10 Bits per second (Bps).
 - f. Loss: Measured at frame output with reference Zero (0) deci-Bel measured (dBm) at 1,000 Hertz (Hz) applied to frame input:
 - 1) Trunk to station: Maximum 1.5 dB.
 - 2) Station to station: Maximum 3.0 dB.
 - 3) Internal switch crosstalk: -60 dB when a signal of + 10 dBm, 500-2,500 Hz range is applied to primary path.

- g. Idle channel noise: 25 dB relative noise per channel (rnC) or 3.0 dBm at 0 above (terminated) ground noise, whichever is greater.
 - h. Traffic Grade of Service for Voice: Minimum grade P-01 with an average traffic load of 7.0 One Hundred Call Seconds (CCS) per station per hour.
 - i. Average CCS per Voice Station: CCS capacity maintained at 7.0 CCS and a Time Between Failures (TBF) of 99.99 percent when system is expanded up to the projected maximum growth.
- E. Voice and Audio Standards:
- 1. Input and Output Signal Level: 0.0 dBm at 1 kilo Hertz (kHz) test tone modulation level.
 - 2. Input and Output Impedance: 600 Ohms Balanced (BAL).
 - 3. Input and Output Signals: Terminated on each system unit.
 - 4. Frequency Range: Minimum 50 Hertz (Hz) to 3.0 kHz + 1.0 percent.
 - 5. Signal-to-Noise Ratio: 60 deci-Bell per mili-Volt (dBmV) + 1.0 dBmV.
 - 6. Cross Modulation: -46 dB.
 - 7. Hum Modulation: -55 dB.
 - 8. Isolation (control unit to unit): Minimum 24 dB.
- F. Control Signal Standards:
- 1. Input and Output Signal: 0.0 dBmV + 1.0 dBmV Level.
 - 2. Input and Output Signals Terminated on each system unit.
 - 3. Input and Output Impedance: 600 Ohms, BAL.
 - 4. Channel Bandwidth - Voice: Minimum 50 Hz to 3.0 kHz, + 5.0 percent.
 - 5. S/N Ratio: 60 dBmV + 1.0 dBmV.
- G. Telephone Outlet (TCO):
- 1. Isolation (outlet-outlet): Minimum 24 dB.
 - 2. Impedance: 600 Ohms.
 - 3. Signal Level: 0 dBmV+ 0.1 dBmV.
 - 4. System Speed: Minimum 100 mega-Bits (mb) per second.
 - 5. System Data Error: Minimum 10 to the -6 Bits per second.
- H. Auxiliary Systems:
- 1. // Provide Public Address System (PA) interface as described in Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS. //
 - 2. // Provide direct access to selected zones and all zones paging from each telephone console. //
 - 3. // Provide console attendant "priority access" (or ALL CALL or CODE ONE or BLUE) to all zones. Selected station users have access to appropriate zones via sub zones, by dialing the proper access. //

4. // Provide required NFPA and UL certified devices for PA to be interfaced to a designated critical care emergency communications telephone system. //
5. // Provide feature to prevent PA from being "locked up" by a user placing system on hold or leaving receiver off-hook. //

I. General Product Requirements:

1. Provide current model of standard products of OEM of record. OEM of record to be defined as a commercial business enterprise manufacturing items of equipment and which:
 - a. Maintains a factory production line for equipment submitted.
 - b. Maintains a stock of replacement parts for equipment submitted.
 - c. Maintains engineering drawings, specifications, and operating manuals for equipment submitted.
 - d. Has published and distributed descriptive literature and equipment specifications on equipment submitted at least 30 days prior to the Invitation for Bid.
2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated.
3. Where standards are established for supplies, materials or equipment, furnish supplies, materials and equipment listed by NRTL.
4. Provide equipment labeled with approved seal of NRTL.
5. Provide COR with verification, at time of installation type of cable being provided is recommended and approved by OEM. Provide cabling meeting requirements of NRTL, TIA Wiring Standards and requirements of NFPA 70. Coordinate correct protection, cable duct and conduit with subcontractors.
6. Interface with telephone //, PA// and, _____// systems utilizing interfacing methods approved by OEM and Government. Acceptable interfacing method requires not only a physical and mechanical connection, but includes matching of signal, voltage, and processing levels, with regard to signal quality and impedance. Provide separation of Critical Care, Life Safety, and Emergency systems.
7. Connect //PA// interface cabling from system via its system telephone interface unit using telephone equipment and //PA interface equipment// as interface point. Furnish telephone interface unit //and PA interface unit; do not install connections to PA system. //

8. Provide solid state active electronic component rated for continuous duty service and complying with FCC standards, for telephone equipment, systems, and service.
9. Provide passive distribution equipment with -80 dB radiation shielding specifications or greater.
10. Terminate interconnecting twisted pair cables on equipment terminal boards, punch blocks, breakout boxes, splice blocks. Terminate unused equipment ports/taps according to OEM's instructions for telephone cable systems without adapters. Terminate unused or spare twisted pair cable, and fiber-optic cable that is unconnected, loose or unsecured.
11. Utilize microprocessor components for signaling, programming circuits and functions. Ensure program memory is non-volatile or protected from erasure during power outages for a minimum of three days.
12. Provide continuous electrical supervision of system equipment, interconnecting cabling, distribution cable plant, and UPS back up battery and charger to determine change in status and to assist in trouble shooting system faults.
13. Voltage: Not to exceed 30V AC Root Mean Squared (RMS) or 42V direct current (DC), except for primary power to power supply circuits.
14. Color Coded Distribution Wiring: Conform to ANSI/TIA-606-B standard. Clearly and permanently label equipment, cable duct and conduit, enclosures, wiring, terminals, and cables according ANSI/TIA 606-B standard record wiring diagrams, to facilitate installation and maintenance.
15. Connect primary input power to critical branch of emergency AC power distribution system.
16. Provide UPS sized for equipment to function and operate normally during input power fluctuations or loss of power for a minimum of four hours.
17. Provide plug-in connectors to connect equipment.
18. Utilize barrier terminal screw type connectors, at a minimum for base band cable systems.
19. Crimp Type Connectors:
 - a. Type installed with a ratchet tool are an acceptable alternative if cable dress, pairs, shielding, grounding, connections and labeling are provided same as barrier terminal strip connectors.

- b. Tape of any type, wire nuts, or solder type connections will not be permitted.
- 20. Provide stainless steel, anodized aluminum faceplates, or UL approved cycolac plastic matching equipment.
- 21. Provide noise filters and surge protectors for each equipment (including interface cabinets) control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches.

2.2 EQUIPMENT

A. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
Power Line Frequency	60 Hz \pm 2.0 Hz
Operating Temperature	0 to 50 degrees centigrade (C)
Humidity	80 percent minimum rating

SPEC WRITER NOTE:

1. VoIP systems require prior acceptance of SMCS 0050P2H3 202-461-5310 and COR prior to incorporating in design.

B. System Equipment:

1. Self-contained, electronic, digital // and VoIP // in operation, providing the following minimum functions:
 - a. Intra-facility station-to-station four digit direct dialing to include those telephone instruments equipped with DID features.
 - b. Direct-output-dial (DOD) from any unrestricted telephone instrument to any CO trunk, ISDN, or FTS access lines by dialing a pre-designated access code.
 - c. DOD from any station to tie lines by dialing a pre-designated access code.
 - d. Ability of incoming calls from FTS access lines and tie lines to direct dial system stations without attendant assistance.
 - e. Access to outside lines through operator's console at restricted telephone instruments.
 - f. Access to features, functions, CO trunks, FTS access lines, tie-lines, toll free numbers, and long distance directory assistance from unrestricted telephone instruments.
 - g. Minimum 40 Class-of-Service (COS) restrictions to be applied individually or in combination as dictated by individual

telephone number service requirements. Describe number and type of COS restrictions available in submittals.

2. Provide station users with standard feature package listed by this paragraph, and provide ability to restrict any of these features on a station by station basis.
 - a. Line Hunt Capability: Assign sequential and circular line hunting lines to a hunt group submit number of hunt groups available and capacity of each group.
 - b. Consultation Hold: Capability to place an incoming call on hold while making a consulting call, then return to original call.
 - c. Call Transfer: Permit a user to transfer an incoming or outgoing CO trunk, FTS, or tie-line call to another system station without attendant assistance.
 - d. Call Pick-Up: Answer a ringing, but unanswered call, within a pre-designated group of station lines by dialing a feature code or activating a feature button.
 - e. Call Forwarding "Follow Me" Functions: Automatically reroute incoming calls to another selected telephone number. Activate and deactivating this feature from selected telephone instruments at their discretion.
 - f. "Busy and Don't Answer" Functions: Automatically reroute calls to a pre-programmed secondary telephone instrument when a given telephone instrument is busy or does not answer within a prescribed time interval.
 - g. Call Queuing: Telephone instrument encountering a busy trunk, e.g. CO, FTS, Foreign Exchange Service (FX), and tie-lines, can be automatically connected to the trunk when it becomes available.
 - h. Call Back/Ring Back: Call back/ring back is activated at calling instrument initiating call to another internal busy instrument by an access code or feature button. Automatically ring calling instrument when both instruments become idle, and when answered, rings called instrument without preventing calling instrument from originating or receiving other calls.
 - i. Music on Hold: Provide music on hold to system station lines, CO trunks, FTS access lines, and tie-lines when placed on hold. Acceptable music source is digital media player as accepted by

SMCS 0050P2H3 and COR. Off air radio or non-royalty sources cannot be used for this function.

- j. Conferencing: A telephone instrument initiated conference (minimum of three parties) which allows stations to conference any combination of telephone instrument, CO, or FTS calls.
- k. Automatic Number Identification: A facility where directory number or equipment number of a calling instrument is obtained automatically for use in message accounting.
- l. Station to Station Call Waiting: Busy telephone instruments allowed to receive a second incoming call from another telephone instrument. Play call waiting tone on busy instrument, upon receiving a second incoming call. The busy instrument has ability to place initial call on hold and answer second call and alternate between both calls.
- m. Station and System Speed Dialing:
 - 1) System Speed Dialing: Minimum 50 numbers allow designated telephone instruments to originate speed calls to CO, FTS, FX, or tie lines.
 - 2) Station Speed Dialing: Ten numbers per instrument; instrument includes capability of entering, removing, or changing numbers programmed on their Station Speed dialing list.
- n. Call Park: Telephone instrument feature must be provided that allows non-preselected internal instruments to access an attendant initiated feature in response to an internal/external paging situation.
- o. Universal Night Answer Service: Provide a means of night service transfer for answering incoming calls, which would normally be answered at console, from locations other than console. Chimes, with cut-off switches, to announce incoming calls placed at two locations.
- p. Line Load Control: A pre-programmed attendant controlled feature which, when activated from console positions, restricts all but selected stations from accessing FTS and CO trunks during emergency conditions. Activation of line load control must not affect intra-facility communications, e.g., station to station, access to Public Address system, audio-page, etc.
- q. Dual Common Controls: The following are the minimum features required:

- 1) Provide a redundant common processing unit with automatic transfer capability offering a stored program technology control feature.
 - 2) Either common control is capable of handling the total system traffic load without degradation of service.
 - 3) In event of failure of primary common control automatically switch to redundant unit with no interruption to calls in progress and no loss of program features.
- r. Line Lock Out:
- 1) In event a telephone instrument handset is not replaced in telephone instrument cradle, after a pre-determined time interval with no dial action lock out that station line, i.e., not tie up system switch equipment.
 - 2) Apply audible tone to locked out station lines.
 - 3) Automatically restore associated station line to full service when a locked-out telephone instrument handset is replaced.
- s. Supervisory Telephone (not Electrical or Electronic) Signaling and Ringing:
- 1) Provide dual solid state signal generating devices, or equivalent, which produce standard supervisory signaling, i.e., ringing, dial tone, busy tone, etc. A maximum one-third of installed main station line capacity can be affected by failure of any one signal generating device.
 - 2) Provide automatic transfer to alternate signal generating device in event of failure of primary device for dual solid state signal generating devices.
 - 3) Supervisory Signaling and Ringing:
 - a) Provide tones to indicate progress of a call through the exchange, i.e. dial tone - to indicate that switching equipment is ready to receive dial digits and, when required, provide a secondary dial tone for FTS 2000 access; busy tone (60 to 120 interruptions per minute) - to indicate that a busy line or trunk has been encountered; audible ring back tone - to indicate to calling subscriber that the number dialed is being called.
 - b) Provide supervisory signaling and ringing devices capable of operating from emergency DC power source.
- t. Fusing:

- 1) Equip system with fuses to protect total telephone system and individual segments of system so that a problem in one segment can be isolated without damaging the total system.
 - 2) Provide alarm indicating type fuses with their rating designated by numerical or color code on fuse panels that are easily visible.
- u. Equipment Power Supply:
- 1) Equip system with a complete on-line power supply consisting of AC surge protection, dual load-sharing rectifiers/chargers, batteries, and inverter.
 - 2) Capacity of power supply must support system including projected maximum growth and as required in this specification for interfaced equipment.
 - 3) Coordinate with Local Exchange Company (LEC) to determine CO trunk, FTS access line, and other required interface unit power requirements and provide power to interface units so they can continue to function in event of a commercial AC power failure.
- v. UPS with Battery Back-up or Reserve Battery Power Supply:
- 1) Provide reserve battery power supply with capacity to supply system for a minimum of four hours including projected maximum growth and interfaced equipment consisting of minimum // 24 //_____ // sealed maintenance-free cells. Dry cell batteries are not acceptable. Include capability of adjustable voltage for float or equalizing batteries.
 - 2) Provide fully redundant system (not including batteries and inverter) with rectifier or charger capacity to support combined load requirements of system at its maximum growth and interfaced equipment.
- w. Alarms and Trouble Indicators: It is acceptable to combine required electrical and electronic supervision functions in these panels provided supervisory standards are met.
- 1) Provide and make operational visual and audible alarms, equipped with cut-off switches, indicating AC power failure, rectifier failure, major and minor trouble, temperature/humidity, electrical or electronic supervisory alarms. Provide sensors for remote environmental alarms at attendant console area and one other location. Separate these

alarms in addition to major and minor alarms on attendant consoles.

- 2) Provide small red indicator lamps on alarm panel for each alarm with cut-off switches or one switch for all alarms and distinctive audible alarms. If one cutoff switch is provided for all audible alarms, restore alarms to ready status condition for audible registration of additional alarms.
 - 3) On submittal describe other system alarms that are remote and describe system alarms/indicators of malfunctions that are located on the equipment.
- x. Provide capability of system to provide four-digit intra-station dialing and desired functions described herein.
 - y. Due to varied trunk group requirements and possible future trunk group requirements, e.g. public address system access, alternate access codes can be proposed. Grouping of similar type trunk group/features, e.g. 5-1 public address system (all call), 5-2 public address system zone 1, etc. is acceptable.
 - z. Provide emergency numbers accessible by system station users. Label numbers on console or a multi-line instrument and at least one other designated location. Provide a distinctive audible and visual signal associated with emergency number to ensure an immediate response to calls. Provide capability of priority answering emergency number and extending the call as situation dictates at console or multi-line instrument. A modified trunk circuit can be used for this purpose.
 - aa. Provide sensitivity for voice service up to 914.4 m (3,000 feet).
3. Voice Mail Requirements:
- a. Requirement is an automated call processing capability. Connect automated attendant to system and configured to answer and route calls received on a predetermined number of central office trunks. Configure system so that, if called extension is busy or does not answer within a predetermined number of rings, route caller to person's voice mail box. Provide complete voice mail system allowing predetermined number of users to send complete and confidential messages in users' voice and receive complete and confidential messages in senders' own voice 24 hours per day, 7 days per week. Integrate into operation of system and be compatible with local telephone company central office.

- b. Provide capacity for the following number of ports (minimum):

	Equipped Capacity	Wired Capacity
Automated Attendant	12	20
Voice Mail	12	20

- c. Provide voice mail system for 500 mailboxes and 40 hours of storage with growth to 60 hours of storage.
4. Voice Mail Features:
- a. Access to system and its features from any instrument anywhere that provides DTMF signaling.
 - b. Ability of those leaving a message to review message and edit message that is being placed in mailbox.
 - c. Privacy/Security through use of a password.
 - d. Ability to send messages to users on voice mail system in the following manner:
 - 1) To any user on same voice mail system.
 - 2) To more than one user on same voice mail system - an ad hoc distribution list determined by sender at time of message transmission.
 - 3) To a predetermined distribution list.
 - 4) Broadcast to users on same voice mail system.
 - e. Verification, with Receipt: Ability of a user to request and receive verification of when a message is played through the use of a touch-tone command. Indicate time and date of when a message is played and place that information in sender's mailbox.
 - f. Envelope Information: Ability of a user to request and receive time and date information of when specific messages were left in user's mailbox.
 - g. Connects to voice mail system through system extension number or a seven/ten digit telephone number from LEC.
 - h. Message "PROMPTS" for every transaction: Provide Messages for "GREETINGS" and "INSTRUCTIONS FOR RECORDING OR EDITING A MESSAGE".
 - i. Notify user that messages are in user's mailbox with a message waiting tone, lamp, and display.
 - j. Notify user, upon accessing system, of how many messages are in user's mailbox.
 - k. Message Response Alternatives:

- 1) Respond or send a reply to another user on same voice mail system.
 - 2) Route message to another user on same voice mail system.
 - 3) Delete message.
 - 4) Save message.
- l. Ability to fast forward or rewind messages.
 - m. Present messages to user on a "FIFO" basis.
 - n. User Administration: Provide management information and statistics in the following categories:
 - o. Port Usage: Traffic statistics on each access path into system.
 - p. Usage of Storage Capacity: Remaining storage capacity at any one time and during peak periods.
 - q. Mailbox Usage: Connect time and number of new or saved messages.
 - r. User administration terminal to allow for "Class of Service Controls" in the following areas and for the following parameters:
 - 1) Initial Authorization:
 - a) Ability to enable a mailbox.
 - b) Record "Owner's" name.
 - c) Set initial Pass Number.
 - 2) Usage Control:
 - a) Length of personal greeting.
 - b) Length of messages received.
 - c) Number of messages.
 - d) Message retention time.
 - 3) Feature Authorizations: Allowed or not.
 - a) Group List Creation.
 - b) Group List Usage.
 - c) Broadcast Messages.
- C. Voice Traffic Management System (TMS):
1. Provide complete and self-contained on-site TMS.
 2. Functions:
 - a. Provide laser printer for reports generated by system and maintenance administration terminal.
 - b. Connect TMS to system emergency battery power supply.
 - c. Screen menus to provide access to each category of reports.
 - d. Traffic Accounting and Management Call Detail Recording (CDR) for Voice Circuits (TMS):

- 1) Include hardware, software, and interconnections for complete system.
- 2) Contain a database stored on non-volatile media.
- 3) Provide line numbers, physical locations of equipment by building and room number, department to which a line is assigned, name of persons assigned to a number, type of equipment, and any comments regarding system features.
- 4) Support additional input and output (I/O) ports for video monitors or other terminals that allows a passive display of data bases by authorized medical center personnel other than those individuals responsible for data input and conducting studies.
- 5) Protect data bases with user ID and password.
- 6) Provide separate voice line reports, on demand and predetermined schedule, for automatic printing. The following reports are required:
 - a) Originating trunk traffic by trunk group, expressed in CCS.
 - b) Terminating trunk traffic by trunk group, expressed in CCS.
 - c) All trunks busy, by trunk group, expressed as blocked call count.
 - d) All equipment busy, i.e., no dial tone and failure to complete cross-office call because of all equipment busy, expressed in blocked call count.
 - e) List of equipment alarms, error tables, trouble logs, history files, etc.
- e. Measurements for each console:
 - 1) Incoming calls.
 - 2) Calls answered.
- f. Provide remote video monitors compatible with TMS hardware and software in immediate vicinity of telephone operators for use as an on-line directory lookup system of facility personnel.
- g. Print reports in English notation that do not require interpretation of abbreviations or codes by the user.
- h. Provide storage on disk to prevent a purge of stored data. Maintain call record and facility usage data in database for a minimum 30 days with storage capability of accommodating a minimum 5,000 calls per day.

- i. Furnish normal system traffic data to appropriate facility staff within seven days of a facility request. Prepare quarterly and submit, to appropriate facility staff, a comprehensive traffic study, including the required traffic data with the contractor's comments and recommendations.
 - j. Load and maintain directory that includes, name, title, organization, location, extension, and class-of-service.
 - k. Provide cable plant management function with the following minimum requirements:
 - 1) A list of off-premise cable by circuit number, numbers of pairs for each circuit, and circuit definition.
 - 2) Complete cable plant distribution record to identify location (cable pair) on main distribution frame, riser, cable size, cable pair in-use (main cable feeder and station cable), building and room number of termination, and equipment type terminated.
 - 3) Automatically provide the cable number and pair assignments, when service order is entered.
 - l. Provide equipment inventory list containing the following minimum requirements:
 - 1) System cabinets, cards (active and spares), batteries, current and surge protectors, rectifiers, peripheral equipment, i.e. public address etc.
 - 2) Quantity of single and multi-line telephones, speakerphones, dial intercom units, speakers, gongs, loud horns, bells, chimes, recorders, etc.
 - 3) A list of equipment as being used or spare; ordered or received; installed date, warranty date, cost, location, serial number, etc.
 - m. Provide electrical and/or electronic supervisory alarms and faults reports.
- D. Attendant Console:
- 1. Attendant consoles must be compatible with local commercial telephone system:
 - a. Powered from system's emergency battery power supply.
 - b. Load sharing to ensure that all incoming calls are evenly distributed among consoles regardless of traffic load.

- c. Telephone signal (not electrical or electronic) supervision over all calls connected through console providing indication of:
 - 1) Called party answer (revert back to attendant if no answer).
 - 2) Trunk group busy.
 - 3) Station Recall to Attendant: In event of an incoming call being placed (in a hold status) prior to a station being dialed after a specified time this call must revert to the attendant.
- d. Call transfer capability by attendant.
- e. Automatic ring of called station with ring back tone provided to calling party.
- f. Console designed for operation as far as 304.8 m (1,000 feet) from PBX equipment cabinets serviced by a 0.205 mm² (24 AWG) cable.
- g. Attendant console must provide:
 - 1) Ability to enter any on-going voice call, regardless of whether call was connected through console, direct-in-dial, or originated as an intra-station call. Apply warning tone when attendant enters an on-going voice call.
 - 2) "Call-splitting" ability that permits attendant to exclude either outside or inside party when handling trunk calls.
 - 3) "Camp-on busy" feature, that permits attendant to place incoming voice calls on hold until called station number, is available. Tone burst to be applied to busy line to alert that a call is waiting.
 - 4) When busy line becomes free, the waiting call is automatically connected. If waiting call is not connected after a pre-determined time, the waiting call reverts to the attendant.
 - 5) Universal Night Answering Service: Provide ability for incoming calls to be answered from a location other than console.
 - 6) On-the-ear models attendant headsets, equipped with coiled cord, plug-In case amplifier, and quick disconnect for 10 attendants. Submit type of headsets to be provided.
 - 7) One supervisor plug-in handset with a push-to-talk button and a nine-foot cord.
 - 8) Dual tone multi-frequency dialing for attendant completion of incoming, outgoing, and intra-station calls.

- h. Automated Attendant Features:
 - 1) Access from any instrument anywhere that provides DTMF signaling.
 - 2) Voice "PROMPTS" for every transaction.
 - 3) Introductory greeting.
 - 4) Ability of caller to enter extension of the person being called and connection to that extension or enter zero for connection to operator.
 - 5) Capability of providing caller with a directory and sub-directories of telephone numbers and ability to enter desired extension at any time while listening to directory.
- E. Cross-Connection System (CCS) Equipment: Breakout, termination connector (or bulkhead), patch panels, and connection assemblies, in addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATION, must include the following:
 - 1. Connector panels made of flat smooth 3 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in cabinet.
 - 2. Bulkhead equipment connectors mounted on panel to enable cabinet equipment's signal, control, and coaxial cables to be connected through panel.
 - 3. Each panel color matching cabinet installed.
- F. Voice (or Telephone):
 - 1. 110-type punch blocks certified for Category 6 represent the minimum requirement for voice or telephone, and control wiring instead of patch panels. Category 6 IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS. Secure punch block strips to OEM designed physical anchoring unit located on a wall in Demarc Room, Telephone Equipment Room, and TR. However, console, cabinet, rail, panel, etc. mounting is allowed at OEM recommendation and as accepted by COR. Punch blocks will not be accepted for Class II or 120 VAC power wiring.
 - 2. Technical Characteristics:
 - a. Number of Horizontal Rows: Minimum 100.
 - b. Number of Terminals per Row: Minimum 4.
 - c. Terminal protector: Required for each used or unused terminal.
 - d. Insulation Splicing: Required between each row of terminals.
- G. Fiber Optic and Analog Audio:

1. Product reference type must be tele wire, PUP-17 with pre-punched chassis mounting holes arranged in two horizontal rows. This panel can be used for fiber optic, audio, control cable, and Class II Low Voltage Wiring installations when provided with proper connectors. This panel will not be permitted for 120 VAC power connections.
2. Technical Characteristics:
 - a. Height: Minimum two RUs, 89 mm (3.5").
 - b. Width: Minimum 484 mm (19 1/16"), EIA.
 - c. Number of Connections: Minimum 12 pairs.
 - d. Audio Service: Use RCA 6.35 mm (1/4 inch) Phono, XL or Barrier Strips, surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained).
 - e. Control Signal Service: Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained).
 - f. Low Voltage Power (Class II): Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted.
 - g. Fiber Optic: "LC" Stainless steel, female.

H. Mounting Strips and Blocks:

1. Barrier Strips:
 - a. Barrier strips are permitted for AC power, data, voice, and control cable or wires that accommodate size and type of audio spade (or fork type) lugs used with insulating and separating strips between terminals for securing separate wires in orderly fashion.
 - b. Provide barrier strips with audio spade lug, which is connected to an individual screw terminal on barrier strip at each cable or wire end.
 - c. Secure barrier strips to console, cabinet, rail, panel, etc. Do not connect 120 VAC power wires to signal barrier strips.
2. Technical Characteristics:
 - a. Terminal Size: Minimum 6-32.
 - b. Terminal Count: Any combination.
 - c. Wire Size: Minimum 20 AWG.
 - d. Voltage Handling: Minimum 100 V.

- e. Protective Connector Cover: Required for Class II and 120 VAC power connections.
 - 3. Solderless Connectors: Crimp-on insulated lug to fit 6-32 minimum screw terminal. Install fork connector using standard crimp tool.
 - 4. Furnish items for balancing and minimizing interference capable of passing telephone signals in frequency bands selected, in directions specified, with low loss, and high isolation and with minimum delay of specified frequencies and signals. Provide equipment necessary to meet requirements of this section and system performance standards.
- I. Audio Monitor Panel:
- 1. EIA standard panel for mounting in upper portion of 480 mm (19 inches) system equipment cabinet. This unit can be combined in system's Annunciating System and Electrical Supervision Panel, in order to achieve the minimum electrical supervision requirements of system. Refer to system technical data for additional required specifications.
 - 2. Technical Characteristics:
 - a. Monitor Speaker: A permanent magnet, 76 mm (3 inch) minimum diameter, and a monitor volume control.
 - b. Audiometer: Easy to read volume unit (vu) or similar meter with illuminated scale and meter calibrating control.
 - c. Channel Selector Switch: Six positions (Off, 1, 2, 3, 4, and Spare) which connect monitor speaker and VU meter to selected audio channel.
- J. Electrical Supervision Panel:
- 1. Provide electrical supervision panel in system cabinet and Telephone Operator, // and _____// locations and as designated on drawings compatible with system's Trouble Annunciation Panel and Audio Monitor Panel, to generate electrical and electronic supervising signals to continuously monitor operating condition for system, CSU, telephone instruments // , and _____ // , and interconnecting cable trunks. Generate an audible and visual signal when system's supervising system detects system, CSU, //, and _____ //, or trunk line is malfunctioning.
 - 2. Technical Characteristics:
 - a. Silence Button or Switch: Silence the audible signal; visual signal must continue until supervisory circuit indicates fault is corrected.

- b. Visual Enunciators: Visually show amplifier and trunk-line unit or supervisory circuit is in fault condition.
- K. Telephone Instruments:
- 1. Provide telephone instruments equipped with inductive capability to radiate a magnetic field required to activate hearing aid telecoil and to provide personnel, who use hearing aids, access to all telephones within facility.
 - 2. Provide station equipment consisting of standard single line instruments, patient bedside instruments, and multi-line digital electronic telephone instruments with digital display, of latest design.
 - 3. Provide telephone instruments except patient bedside phones, with a flash button (or equivalent feature button) with pre-determined timing feature to initiate consultation hold and other features normally initiated by operation of hook-switch. Flash button must be distinct from hook-switch.
 - 4. Attach laminated faceplate listing most common user features and their appropriate access codes to telephone instruments, except patient bedside phones. Faceplates can be an integral part of instrument housing or be an adhesive backed decal applied over tone pad area of housing at time of telephone set installation.
 - 5. Provide station instruments feature compatible and with transmission characteristics compatible with proposed system.
 - 6. Provide telephone instrument signaling by means of standard adjustable, buzzers, chimes, or electronic tone, unless otherwise specified.
 - 7. Single Line Instruments:
 - a. Single line instruments can be electronic or 2500-type analog phones.
 - b. Single line instruments used must be capable of supporting bridged cabling to allow a single phone number on multiple instruments without using multiple switch ports.
 - c. Single line instruments must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment without using multiple switch ports.
 - 8. Multi-Line Instruments, Digital and Electronic - Features:

- a. Digital read-out display and with minimum 14 programmable (lines or features) buttons.
 - b. Adjustable electronic tone to announce calls.
 - c. Detect an incoming call to multi-button instrument and provide an audible signal only on designated lines.
 - d. Lights to identify called line and remain illuminated for duration of call.
 - e. Associate telephone intercom systems with these instruments.
 - f. Equipment associated with intercom systems can require special features such as built in microphone and speaker. Provide secretaries with a means of announcing calls to offices with extensions or pickups on system. Identify provision of intercom systems during required data base survey and provide any required intercom systems.
 - g. This equipment must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment. Use of analog switch ports to provide ringing voltage, if required, is acceptable and include these switch ports in equipped capacity.
 - h. Provide hot line telephones between two identified points equipped with two-way automatic ring and cut-off controlled by telephone hook-switch, i.e. when near-end hand set is removed from hook switch, far-end telephone rings until hand set is removed from hook-switch.
- SPEC WRITER NOTE:
- 1. Requirements for hands-free operated facilities to be identified on drawings.
- i. Configure speaker on hands-free telephone stations to be used as both transmitter and receiver to answer or initiate a call. These facilities to normally be used as a hot line between two points.
9. Patient Bedside Instruments - Features:
- a. Maintenance free, sanitized packet, and capable of supporting table top, side-rail, top bed-rail, or wall mounting. Provide each phone with minimum 15 feet of self-contained line cord.
 - b. At the discretion of the facility, patient bedside instruments can be discarded, cleaned for reuse, or given to the patient, as appropriate. Expected anticipated cost per instrument does not exceed ten dollars.

- L. Lightning Protection System: Provide totally external to building. The use of internal electrical wiring for lightning grounding systems will not be permitted.
1. Provide ground system, cabinets, racks, wire management systems, cable shields, etc. with copper wire run external to building and bond to grounding electrode conductor or inter system bonding termination. If these items are installed in an area not protected by lightning protection system, immediately notify COR of lightning strike hazard.
 2. Telephone, Data, Audio, and Coaxial Cable Lightning Protector:
 - a. Provide in-line device with screw type connectors to match coaxial and STP or UTP cable specified. Locate at each building entrance where each cable enters a building from the outside and grounded with stranded copper wire run external to building bonded to grounding electrode conductor to shunt high current surges to earth ground and have a minimal effect on quality of signal being received or transmitted. Provide protector made of non-corrosive metal and waterproof. Refer to system technical data for additional required specifications.
 - b. Technical Characteristics:
 - 1) Peak Pulse Power: 1500 W at 25 degrees C (77 degrees F).
 - 2) Protection Device: Gas Tube or as required by OEM.
 - 3) Dissipation: 1.0 Milliseconds (MS).
 - 4) Response Time: 5.0 nS.
 - 5) Connectors: As specified.
 - 6) Ground Wire: Minimum #6 AWG Stranded Copper, or as required by OEM and Government.

SPEC WRITER NOTE:

1. Delete following subsection if not appropriate for project.

2.3 AUXILIARY SYSTEMS

- A. Interface system to Public Address System identified in Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS with technical instructions from COR.
1. Provide console attendants direct access to selected zones and all zones paging. Provide attendant "priority access" to all zones.
 2. Provide selected station users access to appropriate zones, by dialing proper access.

3. Provide required interface devices to PA. Provide a feature to prevent PA from being "locked up" by a user placing the system on hold or leaving receiver "off-hook".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install according to following Industry Standards:
 1. NFPA Section 70, National Electrical Code (NEC), Article 517 and Chapter 7.
 2. NFPA Section 99, Health Care Facilities, Chapter 3-4.
 3. NFPA Section 101, Life Safety Code, Chapters 7, 12, and 13.
 4. Joint Commission Manual for Health Care Facilities, Life Safety and Support guidelines.
 5. These specifications.
 6. OEM installation, design, recommendations, and instructions.
- B. System Installation:
 1. Install suitable filters, traps, directional couplers, splitters, telephone outlets, and pads for minimizing interference and for balancing amplifiers and distribution systems.
 2. Connect passive equipment according to OEM's specifications to insure correct termination, isolation, impedance match and signal level balance at each telephone outlet.
 3. Terminate lines in a suitable manner to facilitate future expansion of system.
 4. Terminate vertical and horizontal copper and fiber optic //, and coaxial // lines in system, TER, MCR and TR equipment only.
 5. Install terminating resistors or devices on unused branches, outlets, and equipment ports of system designed for purpose of terminating fiber optic or twisted pair // , and coaxial // cables carrying telephone //, and analog video// signals in telephone // , and analog // systems.
 6. Install equipment outdoors in weatherproof enclosures with hinged doors and locks if equipment is not weatherproof. Provide a minimum of two keys for each lock.
 7. Install equipment indoors in metal cabinets with hinged doors and locks. Provide a minimum of two keys for each lock and VA Police Access Control System.
 8. Install a triplex outlet with modular jacks and stainless steel face plate for each telephone outlet shown on drawings. Provide

- appropriate modular jack (single or triplex) with appropriate face plate for each outlet location identified and verified on drawings.
9. Install patient and wall telephone instruments on a single modular jack designed for wall telephone instruments and patient wall or PBPV installations.
 10. Install permanent telephone cables in conduit or an enclosed duct system. Obtain acceptance for installation, as determined by Government requirements, without conduit or enclosed duct system in cable tray or mechanically supported and separated from other signal cable systems.
 11. Where cables penetrate fire/smoke partitions, firewalls, or floors, coordinate installation of firestopping material of type accepted by COR.
 12. Install equipment in accordance with specifications for system as recommended by OEM.
 13. Replace ceiling tiles damaged during installation and maintenance service of cable and wire distribution system. Restore immediate areas damaged during system installation and maintenance service.
 14. Run all cross connects to established circuits during installation and maintenance service for contract life.
 15. Remove, on a daily basis, debris and scrap generated in conduct of work.
- C. Rack and Cabinet Equipment Mounting:
1. Install rack mounted equipment on enclosure's equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustments can be conveniently made.
 2. Heavy Equipment:
 - a. Install heavy equipment using rack slides or rails allowing servicing from front of enclosure.
 - b. Install additional support to supplement front panel mounting screws for heavy equipment.
 3. Install cable slack to permit servicing by removal of equipment from front of enclosure.
 4. Install a color matched blank panel (spacer) of 44 mm (1-3/4 inches) high, between each piece of equipment (active or passive) to ensure adequate air circulation maintaining enclosure design for efficient equipment cooling and air ventilation.

5. Provide 380 mm (15 inches) of front vertical space opening for additional equipment. Install color matched blank panels to cover any unused enclosure openings.
 6. Connect signal connector, patch, and bulkhead panels (i.e. PA, telephone, control, etc.) so that outputs from each source, device or system component to enter panel at top row of jacks, beginning left to right as viewed from front; these are to be called "inputs". Install connection to load, device or system component to exit panel at bottom row of jacks, beginning left to right as viewed from front; these are to be called "outputs".
 7. Mount equipment located indoors installed in metal racks or enclosures with hinged doors so it can be accessible for maintenance without interference to other nearby equipment.
 8. Fasten cables to equipment racks or enclosures in a manner that allows doors or access panels to open and close without disturbing or damaging cables.
 9. Install distribution hardware allowing access to connections for testing and provide room for doors or access panels to open and close without disturbing cables.
- D. Conduit, Cables And Wiring, Cable Tray, Raceways, Signal Ducts, Etc:
1. Conduits installed in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
 2. Ensure that Telephone //, and PA // systems (as identified by NEC Section 517) are separated and protected from other systems.

3.2 FIELD QUALITY CONTROL

SPEC WRITER NOTES:

1. If this section is being used in conjunction with specification Section 27 31 31, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT - EXTENSION or Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING the following testing guidelines are in addition to requirements outlined in these documents.
2. Contract SMCS 0050P2H3, (202) 461-5310, for technical assistance and approvals.

A. Interim Inspection:

1. Conduct an interim inspection of installed equipment in presence of COR, prior to proof of performance testing. Verify that equipment provided, adheres to installation requirements of this section.
 2. Install 50 percent of system equipment to include system, interface, origination and junction enclosures powered with permanent AC wiring, outlets, conduit and cables, before interim inspection can take place.
 3. Notify COR of estimated date contractor expects to be ready for interim inspection, at least seven working days before requested inspection date.
 4. Furnish results of interim inspection to COR and PM. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation. SMCS 0050P2H3, (202) 461-5310, must be a part of this inspection team.
 5. COR, in conjunction with PE, will determine if an additional inspection is required, or if contractor will be permitted to proceed with the installation. In either case, re-inspection of deficiencies noted during the interim inspections are to be part of the proof of performance test. The interim inspection is not permitted to affect the system's completion date. Include test documents as part of system's record wiring diagrams.
- B. Pretesting: Align and balance system, upon completing installation of the system. Pretest entire system.
- C. Pretesting Procedure: During system pretest, verify (utilizing the accepted spectrum analyzer and test equipment) that system is fully operational and meets the system performance requirements. Measure and record the aural carrier levels of each system telephone, at each of the following points in the system:
1. Local Exchange Company (LEC) inputs.
 2. System inputs and outputs.
 3. TER, MCR and TR amplifiers, channel processor and converter inputs and outputs.
 4. System output S/NR for each telephone.
 5. Signal level at each interface point to distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.

6. Submit four copies of recorded system pretest measurements along with pretest certification, to COR.
- D. Pretesting Certification: After pretesting system, notify COR that system is ready for proof of performance testing in presence of a SMCS 0050P2H3, (202) 461-5310, and COR, and that it meets requirements stated in construction documents. Submit notification of system readiness no later than twenty working days prior to scheduled Government proof of performance test. Failure of contractor to comply with these pretest requirements, automatically cancels the scheduled acceptance test.
- E. Acceptance Test:
1. After system has been pretested and contractor has submitted pretest results and certification to COR, schedule an acceptance test date and give COR thirty days written notice prior to date acceptance test is expected to begin include expected length (in time) of test. Test in the presence of COR and an OEM certified representative. Test utilizing accepted test equipment to certify proof of performance. Verify that total system meets specified requirements under operating conditions, and complies with listed system performance standards.
 2. Make only those operator adjustments required to show proof of performance. Demonstrate and verify that installed system does comply with operational requirements. under operating conditions. Rate system as either acceptable or unacceptable at conclusion of the test. Failure of any part of system, that precludes completion of system testing and cannot be repaired within four hours, terminates the acceptance test of system.
 3. Declare entire system unacceptable if repeated failures result in a cumulative time of eight hours to effect repairs and retesting entire system at the convenience of Government.
- F. Acceptance Test Procedure:
1. Mechanical and Physical Inspection:
 - a. COR will tour major areas where system and sub-systems are located, to ensure they are properly installed in place, and are ready for proof of performance acceptance testing. A system inventory including available spare parts must be taken at this time. Verify equipment to ensure appropriate UL certification labels are affixed.

- b. Review system diagrams, record drawings, equipment manuals, AutoCAD files, intermediate and pretest results.
 - c. Failure of system to meet installation requirements of this specification terminates testing.
2. Subsystem Operational Test:
- a. After the mechanical and physical inspection, perform an operational test of each sub-system to verify that equipment is properly connected, interfaced and is operational to meet requirements of this section. If any sub-system is not functionally ready, that sub-system will be declared unacceptable and testing terminated. At this point, contractor is only permitted one hour to correct deficiencies.
 - b. Mutually agree with COR, at this time, to wait one hour or to commence testing of next sub-system.
 - c. Repeated failures of sub-system testing or total system testing, that results in a cumulative time of four hours to effect repairs, is grounds for declaring entire system unacceptable and testing to be terminated. Reschedule retesting at convenience of Government.
3. Sub-system Performance Test: After operational test of each sub-system, verify that performance requirements and standards are met using test equipment. Verify there are no visible signal distortions, such as intermodulation, beats, etc. appearing on any received or generated telephone with A spectrum analyzer, signal level meter and bit error rate analyzer (BERT).
4. Total System Test: Commences only after system and sub-systems have been tested and accepted.
- a. LEC Point of Demarcation: Check system outputs.
 - b. System: Test within 30 days following successful pretesting of system. In addition to compliance with technical characteristics and quantities of equipment specified herein, the final acceptance test provision that 30 continuous days of uninterrupted telephone service, must be completed prior to contractor being deemed in compliance with the contract.
 - 1) For purpose of final acceptance, telephone service is considered interrupted when failure of any contractor provided telephone equipment including batteries, results in an interruption of service. This includes a failure of more than

20 percent of any trunk group, 15 percent of any number group (15 or more stations), operator console, or telephone service to any area determined to be critical by Facility Director. Response time to restore service has bearing upon the term "interrupted service".

- 2) To facilitate system acceptance test and to allow familiarization and training of government employees, activate system, including operator consoles, stations, and equipment a minimum 30 days prior to acceptance test date. Test installed equipment and circuits prior to acceptance by Government. During this "burn-in" period, de-bug the system. Make system available for in-house communications and demonstrate required features to facility staff. Government and contractor will make available trunks // and tie line circuits // are available to system during this "burn-in" period for testing.
5. Individual Item Test: COR can select individual items of equipment for detailed proof-of-performance testing to verify items selected meet or exceed minimum requirements of the specification.
6. Interface Cable Sub-system: Check minimum 75 percent of system outlets and interface points to ensure that system meets performance requirements.
 - a. Each sub-system interface, junction, and connection point or location will be checked.
 - b. Each distribution active and passive item of equipment, signal inputs and outputs must be tested.
7. Distribution Cable Plant Sub-system: For specific distribution testing instructions refer to Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
- G. Test Conclusion:
 1. At conclusion of acceptance test, using the generated punch list (or discrepancy list), Government will reschedule testing on deficiencies and shortages.
 2. If system is declared unacceptable without conditions, retest expenses are borne by the contractor.

3.3 SYSTEM STARTUP

- A. Provide personnel (switch technicians, installers, trainers, project manager, etc.) on premise for seven consecutive days after cutover to

clear any malfunctions that develop, to assign/reassign any software features/COS, and conduct any additional training as required.

- B. Connect telephone equipment located in TER to telecommunications grounding busbar.
- C. Provide system ground between system and interfaced systems such as PA system equipment chassis, etc.
- D. Ensure that other dedicated telecommunications systems applications within facility (i.e., pay stations, electro-writing equipment, facsimile etc.) that require space within TER, MCR and TRs, conduits, and cable pair are accommodated. Coordination between applicable parties is necessary to ensure accommodation of these systems.
- E. Verify all portions of system installation conform to local building and fire codes.

3.4 TRAINING

- A. Furnish services of an OEM trained and certified engineer or technician for two eight-hour classes to instruct designated facility maintenance personnel. Include cross connection, corrective, and preventive maintenance of telephone system and equipment.
- B. Furnish services of an OEM trained and certified engineer or technician, familiar with functions and operation of system and equipment, for two eight-hour periods to train designated facility IRM personnel. Instruct staff personnel in each area where system is installed under this contract. When multiple areas are involved, classes are to be grouped. Coordinate periods of training with COR to ensure all shifts receive required training. Include instructions utilizing hands-on operation and functions of the system.
- C. Before system can be accepted by Government, this training must be accomplished. Schedule training at the convenience of Facilities CO and Chief of Engineering Service.

3.5 MAINTENANCE

- A. Provide COR the ability to contact OEM's central emergency assistance maintenance center and request remote diagnostic testing and assistance in resolving technical problems at any time, during warranty period. Provide remote diagnostic testing and assistance capability to Government.
- B. Response Time during Warranty Period:

1. Respond on-site, during the standard work week, to a routine trouble call within 24 hours of its report. A routine trouble is considered a trouble that causes a sub-system to be inoperable.
 2. Respond on-site to an emergency trouble call within four hours of its report. An emergency trouble is when failure:
 - a. Causes a system to be inoperable at any time.
 - b. Involves more than 20 voice circuits.
 - c. Is of a common control unit, power supply, signal generating device or attendant console.
 3. Respond on-site to a catastrophic trouble call within two hours of its report. System failure is considered a catastrophic trouble call.
 - a. If system failure cannot be corrected within six hours, provide an alternate CPU/Key System/mini- system equipped for a minimum of 100 main station lines, 10 CO trunks, 10 FTS access lines and two operator's consoles.
 - b. Install alternate system to provide emergency service to critical areas as determined by Facility Director within 12 hours (time to commence at end of the six hour trouble shooting period).
 - c. Provide to Facility Contracting Officer (CO), prior to cut-over of main telephone system, a pre-written program disk from programmable alternate system.
 4. Catastrophic trouble calls include failures affecting operation of critical emergency health care facilities (i.e., cardiac arrest teams, intensive care units, etc.) if so determined by Facility Director.
 5. Respond on-site to installation of station or equipment requests for service within:
 - a. Eight hours for emergency installations designated by Facility CO.
 - b. Three working days for routine installations designated by Facility CO.
- C. A standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.
- D. Provide compatible temporary equipment returning system or sub-system to full operational capability, until repairs are completed for any trouble that cannot be corrected within one working day.

E. COR and Facility CO are contractor's reporting and contact officials for system trouble calls, during warranty period.

F. Required On-Site Visits during Warranty Period:

1. Visit, once every twelve weeks, to perform system preventive maintenance, equipment cleaning and operational adjustments to maintain system.
 - a. Arrange facility visits with COR or Facility CO prior to performing maintenance visits.
 - b. Perform preventive maintenance in accordance with OEM's recommended practice and service intervals during non-busy times agreed to by COR or Facility CO.
 - c. Provide preventive maintenance schedule to COR and Facility CO for approval.
 - d. Provide on-site replacement spare parts and equipment, plus test equipment, ensuring they meet OEM's minimum recommended spare parts stock sizing requirements for this specific system.
2. Provide Facility CO a report itemizing each deficiency found and corrective action performed during each visit or official reported trouble call. Provide COR or Facility CO with sample copies of reports for review and approval at beginning of acceptance test.

Minimum reports required:

- a. Monthly summary of equipment and sub-systems serviced during warranty period to COR or Facility CO by fifth working day after end of each month. Describe services rendered, parts replaced, repairs performed and prescribe anticipated future needs of equipment and systems for preventive and predictive maintenance.
- b. Separate log entry for each item of equipment and each sub-system of system listing dates and times of scheduled, routine, and emergency calls. Describe details of the nature and causes of each emergency call, emergency steps taken to rectify situation and specific recommendations to avoid such conditions in the future.
- c. Include in Warranty GFE accepted by contractor, interfaced and installed in system; attach GFE List.

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