

SECTION 27 31 31
VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT EXTENSION

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 extension of an emergency voice communication switching and routing system (here-in-after referred to as "system"), including equipment cabinets, interface enclosures, radio relay racks, stand-by batteries, combiners, traps, and filters; distribution nodes, amplifiers; voice stations or instruments; auxiliary systems; and passive devices including 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.

SPEC WRITER NOTE:

1. Verify that design complies with performance requirements of CFM OI&T Design Guide (current edition) and CFM Electrical Design Manual (EDM-PG18-10, current edition).

1.2 RELATED WORK

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

- E. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES 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. Physical access control system field-installed controllers connected by data transmission network: Section 28 13 00, Physical Access Detection.
- I. Security emergency call communication system: Section 28 52 31, SECURITY EMERGENCY CALL, DURESS ALARM, AND TELECOMMUNICATIONS

1.3 COORDINATION

- A. Coordinate and conduct system data base survey with SMCS 0050P2H3 (202) 461-5310, COR and a member of OI&T Service identifying programming of features, classes of service, and equipment installed by type and physical location as specified in this document and attachments thereto.

1.4 SUBMITTALS

- A. On-Site Survey: Provide on-site system equipment location, cable pathway, TR, TCO, and interconnection survey no later than 18 months prior to completion of facility.
 - 1. Walk through facility and existing locations with construction documents (including accepted changes) and existing survey provided by IRM department.
 - 2. Identify differences in locations between the two surveys and provided to COR in writing within 30 days of the completion of survey.
- B. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit the following:
 - 1. Drawing showing location of system grounding electrode connections and routing of aboveground and underground grounding electrode conductors.
 - 2. Interface cabinet layout drawing.
 - 3. Distribution cabinet layout drawing.
 - 4. Equipment technical literature detailing electrical and technical characteristics of each item of equipment.
 - 5. Engineering drawings of system, indicating calculated signal levels at:
 - a. CSU/DSU output.

- b. Each input and output distribution point.
- c. Proposed system outlet values.
- d. Signal level at each system outlet multi-pin jack.
- 6. Proposed floor plan, based on expanded system configuration of contractor's proposed system for this facility.
- 7. Proposed main backbone, trunk line, riser, and horizontal cable pathways, cable duct, and conduit size requirements (between main TR, remote TR, TER, MCR and devices).
- 8. Two copies of an OEM developed training video presentation for evaluation and approval by COR.
- 9. Table with details of complete record program in spreadsheet for associated station assignments.
- C. 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.
- D. System Data Base Survey Report: After completing survey required under Quality Assurance, submit complete list of equipment to COR for approval by SMCS 0050P2H3, (202) 461-5310, prior to start of installation.

SPEC WRITER NOTE:

- 1. Include following for replacement of existing system.
- E. Needs Analysis Report: Submit a summary report of the needs analysis of existing facility.
 - 1. Report CSU compatible with existing or projected system in a format similar to:

ITEM WIRED	EQUIPPED CAPACITY	WIRED CAPACITY
Main Station Lines:		

ITEM WIRED	EQUIPPED CAPACITY	WIRED CAPACITY
Single Line		
Multi Line (Equipped for DID)		
Two-way DRTL		
Foreign Exchange (FX)		
WATS		
Conference		
Dial Dictation Access		
Radio Paging Access		
Audio Paging Access		
Off-Premise Extensions		
CO Trunk By-Pass		
Monitor w/keyboards		
Printers		
Operator Consoles		
T-1 Access/Equipment		
Maintenance Terminal		

2. Identify projected maximum growth for each item. Identify printed circuit boards and modular cabinets that do not require extensive re-wiring and reprogramming for expanding system to projected maximum growth.
3. Cable Distribution System: Report projected cable and TCO count that coincides with projected maximum growth. Indicate a copper and fiber-optic //, and analog RF, // video, or audio coaxial // distribution requirements plan using following paragraphs as an example:
 - a. Twisted Pair Requirements and Column Explanation:

Column	Explanation
From Building	Identifies building by number or title
Floor	Identifies floor by number (i.e. 1st, 2nd, etc.)
Room Number	Identifies room from which cabling is installed by number
Number of Cable Pair	Identifies cable pair required to be terminated on floor designated by number or number of cable pair (Government Owned) to be retained

Building	Identifies building by number or title
Room	Identifies room number

b. Fiber Optic Cabling Requirements and Column Explanation:

Column	Explanation
From Building	Identifies building, by number or location, from which cabling is installed
Room Number	Identifies room, by number, from which cabling is installed
To Building	Identifies building, by number or location, to which cabling is installed
Room Number	Identifies room, by number, to which cabling is installed
Number of Strands	Identifies number of strands in each run of fiber optic cable
Installed Method	Identifies method of installation in accordance with requirements as designated herein
Notes	Identifies a note number for a special feature or equipment
Building	Identifies building by number or title

4. Indicate each instrument location, type of instrument and class of service as determined by the needs analysis // or as shown on drawings //. Indicate requirements for each system instrument and compare total count to locations identified above.
5. Indicate projected system port count requirements; include total number of spares.

Column	Explanation
MSL	Number of Main Station Lines (MSL) to be associated with instrument.
Instrument and Outlets	Assign following codes:
DS	Desk type - single line
WS	Wall type - single line
DM	Desk type - multi-line
WM	Wall type - multi-line
Jack	Type of jack (i.e. wall, single, dual, triplex, etc.).
Notes	Identifies a note number which spells out a requirement for a special feature or function associated with circuits and equipment on that particular line of the station.

SVC	Identifies using SERVICE.
Position	Identifies primary user of instrument by position description or function.

6. Telecommunication Outlets (TCO): Indicate this category for each outlet location and compare total count to the locations identified and shown on the drawings as a part of the summary report; indicate total number of spares.
- F. Voice Traffic Management System (TMS) Submittals:
1. Submit samples of reports generated by TMS with technical submittal for evaluation of formats and compliance with information field content.
 2. Submit detailed description of method to be used to measure traffic data in the technical submittal.
 3. Submit normal system traffic data to appropriate facility staff within seven days of a facility request. Prepare and submit a complete and comprehensive traffic study, including the required traffic data with the contractor's comments and recommendations, quarterly to appropriate facility staff.
- G. 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.
- H. Provide current and qualified OEM training certificates and OEM certification for all contractor installation, maintenance, and supervisory personnel.
- I. Closeout Submittals:
1. 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).
 2. 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.

J. Maintenance Material Submittals:

SPEC WRITER NOTE:

- 1. Confer with SMCS 0050P2H3, (202) 461-5310 to determine other spare items required to equip system with emergency repair capabilities that completely adhere to system warranty requirements.
- 1. Provide 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. minimum or a compliment as directed by OEM.

1.5 QUALITY ASSURANCE

A. Supervision:

- 1. Provide a full time on-site project manager, effective with issuance of notice to proceed to coordinate and supervise contractor and installer personnel in every phase of installation, training, inspection, cutover, and final acceptance of system. This individual to prepare and deliver COR a complete copy of specifications to include amendments prior to start of installation.
- 2. Coordinate final location of station equipment with COR prior to installation.
- 3. Ensure that the project manager and skilled personnel remain on premise until all items on the punch list for system are completed, inspected, and accepted by COR.
- 4. Be responsible for coordination with LEC relative to interface with commercial telephone system. Also be responsible for removal of voice and data equipment and cabling abandoned by the LEC, Government, or other organizations and not retained for exclusive use by Government as a result of this installation.

SPEC WRITER NOTE:

- 1. Include following for replacement of existing system.
- B. Needs Analysis: Perform a needs analysis of existing facility conducted with representatives from IRM and various departments, to determine system's requirements, and prepare Summary Report.

1. Determine projected maximum growth for each item of system.
2. Provide software and hardware required to equip CSU with items listed under equipped capacity, thirty days prior to system cut-over.
3. Reported "Wired Capacity" to include provision for wiring and equipment listed under wired capacity, with exception of line, data, and trunk cards, and testing thirty days prior to system cutover.
4. Determine printed circuit boards and modular cabinets that do not require extensive re-wiring and reprogramming for expanding system to projected maximum growth.
5. Cable Distribution System:
 - a. Formulate for summary report a projected cable and TCO count that coincides with projected maximum growth.
 - b. Provide systems CCS, cable distribution, and TCO requirements to develop a copper and fiber-optic //, and analog RF, // video, or audio coaxial // distribution requirements plan.
6. System Instruments (Stations): Determine each instrument location, type of instrument and class of service // in addition to those shown on drawings //. Determine projected system port count requirements, including spares.
7. Telecommunication Outlets (TCO): Develop plan for this category by outlet location and compare total count to locations identified and shown on drawings, including spares.
8. Summary Report:
 - a. Depict system features and capacities, in addition to specific site requirements.
 - b. Provide analysis of CSU compatibility with existing or projected system.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 SYSTEM DESIGN CRITERIA

SPEC WRITER NOTES:

1. Confer with respective Chiefs of Police, FMS, OI&T and Engineering Services; AND, technical assistance and approval from VA SMCS 0050P2H3, (202) 461-5310 in order to select and insert following paragraphs 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.

- A. Extend following services generated by existing telephone system. If these services are not generated by an operating existing telephone system, system must be compatible and capable of providing minimum services. Perform following minimum services designed in accordance with and supported by an OEM:
1. Provide continuous inter and intra-facility voice service.
 2. Size and install so loss of connectivity to external telephone system, VoIP and facility's LAN/WAN systems does not affect facility's operation in specific designated emergency operating locations and instruments - i.e. Joint Commission and NFPA 101 listed Analog Emergency By-Pass Phones; Police Emergency Call (elevator cabs, parking lots, stairwells, Duress Alarms & Locator) Equipment; emergency call system, Code Blue, Facsimile machines (fax), Patient Phones.
 3. Inter-operate, connect, and function with existing Local (Telephone) Exchange Company (LEC) Networks, Federal Telephone System (FTS) Inter-city Networks, Inter-exchange Carriers, Integrated Services Digital Network (ISDN) and Voice over Internet Protocol (VoIP). 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. Provide control and switching equipment (voice and digital system) with attendant consoles.
 5. Interoperate with current 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. Provide direct digital connection to trunk level equipment compatible with audio paging, radio paging, Federal Information Processing Standards [FIPPS] publications, Industry Standard digitally multiplexed terrestrial signal carrier (t-carrier) and digital signal level protocols, and external protocol converters.
 8. Connect to "T" and "DS" access/equipment or Customer Service Units (CSU or DTE) used in FTS and other trunk applications.

9. Provide T-1 equipment required to terminate and make operational 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.
10. Contain attendant and operator consoles, video monitors with keyboards, and printers to provide employees directory access from Traffic Management System (TMS) if not provided by existing telephone system or deactivated by system installation. 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.
11. Provide interfacing for operating with Direct-Incoming-Dial (DID) service to stations without affecting intra-facility operation. Provide DID trunk group, operating as a separate trunk group from other Central Office (CO) trunks.
12. Provide 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".
13. Provide standard digital // VoIP // telephone instruments at designated TCOs.
14. Provide at designated TCOs and locations on drawings "Hands Free" digital // VoIP // telephone instruments.
15. Receive specified telephone signals acquired from the LEC and FTS contracted carrier, process and distribute them to designated telephone stations, as determined by Class of Service (CoS).
16. At a minimum, provide one // or _____ // TCOs on each room wall and on either side of each door opening. Only exception is specifically identified "special" locations (e.g., surgical suites, radiology, MRI rooms, labs, patient rooms, warehouse, loading docks, storage rooms, etc.) where usually only two //, or _____// active TCOs are designated and as shown on drawings.
17. Interface and connect telephone multi-pin jack to system via 110 type punch blocks in TR.

18. Perform adjacent channel operation of existing telephone system's local, long distance, and FTS 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 along with appropriate printout and archiving of each processed and distributed channel.
 19. Design system to minimize cross talk, background processor noise, inter-modulation, and other signal interference. Install and interface 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. If not provided in existing telephone system, or deactivated by system installation, provide capability in telephone switch room audio and visual monitoring panels 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, and internal Direct Current (DC) power supply primary voltages and currents; each remote control unit, audio //, and analog RF// interface unit, from TER. Provide capability 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.
- B. System must be capable of interfacing with existing or future planned system.
 - C. System designs "looping" distribution cables from room to room are not acceptable.
 - D. //Provide digital signal processor resources for a non-blocking telephone system.//
 - E. Point Of Local (Telephone) Exchange Company Demarc:
 1. Acquire telephone signal at existing telephone system equipment cabinet or as designated in telephone switch room TC.

- a. Notify COR, in writing, if signals at existing telephone system interface point do not meet minimum signal level and quality, detailing nature of deficiencies, and expected effect on telephone signals in new system.
 - 2. System must acquire telephone signals at // _____ //.
 - 3. A minimum of // _____ // analog emergency telephone connections must be acquired at // _____ // and connected to // _____ // analog back up circuits.
- F. System Location Selection: Locate system cabinets and associated equipment in building //_____// floor.
- G. System Performance Criteria:
- 1. Support and operate in the following functional modes:
 - a. Integrated Services for Digital Networks (ISDN):
 - 1) Basic Rate Interface (BRI).
 - 2) Primary Rate Interface (PRI).
 - b. Fiber-optic Distributed Data Interface (FDDI).
 - 2. System Sensitivity: Provide satisfactory service for at least 3,000 feet for voice locations.
 - 3. //Other _____ //
 - 4. System Controller/Manager:
 - a. System speed: Minimum 1.0 giga-Bits (gb) per second.
 - b. Impedance: 600 Ohms, BALANCED
 - c. Cross Modulation: -60 deci-Bel (dB)
 - d. Hum Modulation: -55 dB.
 - e. System Data Error: Minimum 10 to -10 Bits per second (Bps).
 - f. Loss: Measured at frame output with reference 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 projected maximum growth.

H. Voice and Audio Standards:

1. Input and Output Signal Level: 0.0 dBm at 1 kilo Hertz (kHz) test tone modulation level; each level variable over a 6.0 dB range.
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. S/N 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.

I. 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.

J. Telecommunication Outlet (TCO) Standards:

1. Isolation (outlet-outlet): 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 -6 Bits per second.

K. 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 or all zone paging from each system console. //
3. // Provide console attendant "priority access" (or ALL CALL or CODE ONE or CODE BLUE) to all zones. Selected station users to have access to appropriate zones via sub zones, by dialing proper access. //
4. // Provide required NFPA and NRTL certified devices for Security Management System (SMS) to be interfaced to a designated critical care emergency communications system. //
5. // Install according to appropriate Life Safety Code Standards. //

6. // Provide feature to prevent system from being "locked up" by a user placing system on hold or leaving the receiver off-hook. //

2.2 EQUIPMENT

A. 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 item submitted.
 - b. Maintains a stock of replacement parts for item submitted.
 - c. Maintains engineering drawings, specifications, and operating manuals for items submitted.
 - d. Has published and distributed descriptive literature and equipment specifications on items of equipment submitted at least one year prior to // Invitation for Bid // _____//.
2. Where standards are established for supplies, materials or equipment, provide supplies, materials and equipment listed by NRTL.
3. Provide equipment labeled with approved seal of NRTL.
4. Provide COR with verification, at time of installation, that type of cable being provided is recommended and approved by OEM. Provide cabling conforming to requirements of NRTL, TIA Wiring Standards and requirements of NFPA 70. Coordinate correct protection, cable duct and conduit with installers.
5. Interface with SMS // telephone, // PA, // Radio Paging, // 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.
6. Connect SMS // PA // Radio equipment // interface cabling from system headend via its System interface unit using system equipment and SMS // PA // Radio // interface equipment // as interface point. Provide system interface unit and SMS // PA // and radio // interface units //; do not install connections to PA system // and radio system //.
7. Provide electronic components rated for continuous duty service, and complying with FCC standards for system equipment, systems, and service.

8. Provide passive distribution equipment with -80 dB radiation shielding specifications or greater.
9. Terminate interconnecting twisted pair cables on equipment terminal boards, 110 style punch blocks, or breakout boxes. Terminate unused equipment ports/taps according to OEM's instructions for system cable systems without adapters. Terminate unused or spare twisted pair cable, and fiber-optic cable that is unconnected, loose or unsecured.
10. 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 two hours.
11. 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.
12. Voltage: Not to exceed 30V AC RMS or 42V DC, except for primary power to power supply circuits.
13. Color Code Distribution Wiring: Conform to TIA administration standard.
14. Permanently label equipment, cable duct and conduit, enclosures, wiring, terminals, and cables according TIA 606-B standard and record on wiring diagrams, to facilitate installation and maintenance.
15. Coordinate connection of primary input power to critical branch of electrical distribution system.
16. Verify existing UPS system supports extensions' additional power requirement. If adequate capacity is not present, provide additional equipment required to support normal operation and functions of system including extension (as if there was no AC power failure) in event of an AC power failure 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.
 - a. Crimp type connectors installed with a ratchet type installation tool are an acceptable alternative as long as 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.
 - 19. Provide stainless steel, anodized aluminum faceplates, or UL approved cycolac plastic matching equipment.
 - 20. Provide noise filters and surge protectors for each equipment (including interface) cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches.
- B. Equipment Functional Characteristics:
- 1. Input Voltage: 105 to 130 VAC.
 - 2. Power Line Frequency: 60 Hz \pm 2.0 Hz.
 - 3. Operating Temperature: 0 to 50 degrees Centigrade (C).
 - 4. Humidity: 80 percent minimum rating.
- SPEC WRITER NOTE:
- 1. VoIP systems require prior approved by SMCS 0050P2H3, (202) 461-5310, and COR prior to inclusion in design.
 - 2. Defer to VA's Spectrum Management and COMSEC Service SMCS-0050P2H3 (202) 461-5310),for technical assistance.
- C. Customer Service Unit (CSU)/Data Service Unit (DSU) Equipment:
- 1. Self-contained, electronic, digital // and VoIP // in operation, and provide, fully compatible with existing telephone equipment, a system as a minimum with following functions:
 - a. Intra-Facility station-to-station four digit direct dialing to include those telephone instruments equipped with direct incoming dial 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. Provide Class-of-Service (COS) restrictions to match existing telephone system 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 feature package to match existing telephone system and at a minimum, those listed by this paragraph. 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, making a consulting call, and 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 (F/X), and tie-lines, can be automatically connected to 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. Conferencing: Telephone instrument initiated conference (minimum of three parties) which allows stations to conference any combination of telephone instrument, CO, or FTS calls.
- j. Automatic Number Identification: A facility where directory number or equipment number of a calling instrument is obtained automatically for use in message accounting.
- k. Station-to-Station Call Waiting: Busy telephone instruments are allowed to receive a second incoming call from another telephone instrument. Play call waiting tone on busy instrument, upon receiving a second incoming call. Busy instrument has ability to place initial call on hold and answer second call and alternate between both calls.
- l. 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 must include capability of entering, removing, or changing numbers programmed on their station speed dialing list.
- m. Call Park: Allows non-preselected internal instruments to access an attendant initiated feature in response to an internal/external paging situation.
- n. 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. Provide chimes, with cut-off switches, to announce incoming calls strategically placed at two locations.
- o. 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 (i.e. station-to-station, access to public address system, audio-page, etc.).
- p. Dual Common Controls: Provide following minimum features:
 - 1) A redundant common processing unit with automatic transfer capability offering a stored program technology control feature.

- 2) Either common control capable of handling total system traffic load without degradation of service.
 - 3) Automatic switch, in event of primary common control failure, to redundant unit with no interruption to calls in progress and no loss of program features.
- q. Line Lock Out:
- 1) Lock out station line in the event a telephone instrument handset is not replaced in telephone instrument cradle, after a pre-determined time interval with no dial action (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.
- r. 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 the event of failure, of primary device, for dual solid state signal generating devices.
- s. Supervisory Signaling and Ringing:
- 1) 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.
 - 2) Provide supervisory signaling and ringing devices capable of operating from emergency DC power source.
- t. Fusing:
- 1) Equip CSU/DSU with fuses to protect telephone system and individual segments of CSU so a problem in one segment can be isolated without damaging total CSU/DSU.

- 2) Provide alarm indicating type fuses with their rating designated by numerical or color code on fuse panels that are visible.

u. Equipment Power Supply:

- 1) Equip CSU/DSU with a complete on-line power supply consisting of AC surge protection, dual load-sharing rectifiers/chargers, batteries, and inverter.
- 2) Provide capacity of power supply to support the CSU/DSU including projected maximum growth and as required in this specification for interfaced equipment.
- 3) Provide UPS with battery back-up or reserve battery power supply with capacity to power CSU for four hours including projected maximum growth and interfaced equipment. Provide battery power supply of minimum 24 sealed (dry cells are not acceptable), maintenance-free cells.
- 4) Provide system capable of adjustable voltage for float or equalizing batteries.
- 5) Provide fully redundant system (not including batteries and inverter) so each rectifier or charger has capacity to support combined load requirements of existing system as configured including maximum growth and interfaced equipment.
- 6) Coordinate with local facility system contractor, through COR and Facility Contracting Officer, CO trunk, FTS access line, and other required interface units, power requirements to interface units so they can continue to function in event of a commercial AC power failure.

v. Alarms and Trouble Indicators:

- 1) Provide visual and audible alarms, equipped with cut-off switches, indicating AC power failure, rectifier failure, major and minor trouble, and temperature/humidity alarms. Provide sensors for remote environmental alarms at existing telephone system and one other location. Separate these alarms in addition to major and minor alarm functions.
- 2) Provide small red indicator lamps on alarm panel for each alarm with cut-off switches or one switch for alarms and distinctive audible alarms that can be heard over ambient noise in its respective location. 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 CSU/DSU alarms that are remote and describe CSU/DSU alarms/indicators of malfunctions that are located on the equipment.
- w. Provide capability of CSU/DSU to provide four-digit intra-station dialing and desired functions described herein.
 - x. Due to varied trunk group requirements and possible future trunk group requirements (i.e. public address system access) alternate access codes can be proposed. Grouping of similar type trunk group/features (i.e. 5-1 public address system all call, 5-2 public address system zone 1, etc.) is acceptable.
 - y. Provide emergency numbers accessible by CSU/DSU 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 the emergency number to ensure an immediate response to calls. Provide capability of priority answering emergency number and extending call as the situation dictates at console or multi-line instrument; a modified trunk circuit can be used for this purpose.
 - z. Provide sensitivity for voice service up to 914.4 m (3,000 feet).
 - aa. Provide CSU compatible with existing EBPX or equipped with following features:
 - 1) AC to DC power supplies.
 - 2) Emergency battery power supply.
 - 3) DC to AC inverter power supply (connected to CSU emergency battery power supply).
 - 4) Dual common controls.
 - 5) Redundant signaling supply units or equivalent.
 - 6) Cable distribution frame.
 - 7) Cable distribution system.
 - 8) Programmable emergency telephone numbers.
 - 9) On-site automatic program loading device (tape drives are not acceptable) to reload system memory in case of power or system failure (connected to CSU emergency battery power supply).
 - 10) On-site maintenance administration terminal (MAT) with monitor, keyboard and printer (connected to CSU emergency battery power supply).

- 11) Automatic central office trunk connection to pre-determined stations for emergency trunk by-pass/cut-through service. Provide capability to immediately, upon failure of GFE system, have stations process calls. Equip each of these stations with automatic ground start for outgoing calls if required. Provide single line instruments, if required.

3. Voice Mail Requirements:

- a. General: Provide complete voice mail system allowing predetermined number of users to send complete and confidential messages in user's own voice and receive complete and confidential messages in sender's own voice 24 hours per day, 7 days per week. Integrate into operation of existing telephone 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. Provided 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 dual tone multi-frequency (DTMF) signaling.
- b. Ability of those leaving a message to review the message and edit the message that is being placed in the 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 all 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. Connection to voice mail system through extension number of existing telephone system 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. Notification that messages are in user's mailbox with a message waiting tone, lamp, and display.
 - j. Notification upon accessing system, of how many messages are in the user 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 recorded messages while being reviewed by user.
 - m. Messages presented to user on a First-In, First-Out (FIFO) basis.
 - n. User Administration: Provide management information and statistics in the following categories:
 - 1) Port Usage: Traffic statistics on each of the different access paths into system.
 - 2) Usage of Storage Capacity: Remaining storage capacity at any one time and during peak periods.
 - 3) Mailbox Usage: Connect time and number of new or saved messages.
 - o. User administration terminal that allows 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.
- D. Call Detail Reporting (CDR):
 - 1. Provide complete and self-contained on-site CDR compatible with existing telephone system.
 - 2. Functions:
 - a. Provide laser printer for reports generated by system and maintenance administration terminal.
 - b. Connect CDR to system emergency battery power supply.
 - c. Include screen menus to provide access to each category of reports.
- E. Traffic Accounting and Management System (TMS) for voice circuits:
 - 1. Include hardware, software, and interconnections to CSU/DSU.
 - 2. Include a database stored on non-volatile media.
 - 3. Provide line numbers, physical locations of equipment by building and room number, the department to which a line is assigned, name of persons assigned to a particular number, type of equipment, and any comments regarding CSU/DSU 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, V&H coordinates etc.
7. Measurements for each Console:
 - a. Incoming calls.
 - b. Calls answered.
 8. 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.
 9. Print reports in English notation that does not require interpretation of abbreviations or codes by user.
 10. 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.
 11. Load and maintain directory that includes, name, title, organization, location, extension, and class-of-service.
 12. Provide cable plant management function with the following minimum requirements:
 - a. A list of off-premise cable by circuit number, numbers of pairs for each circuit, and circuit definition.
 - b. Complete cable plant distribution record to identify location (cable pair) on main distribution frame (MDF), the riser, the size cable, cable pair in-use (main cable feeder and station cable), building and room number of the termination, and equipment type terminated.
 - c. Cable number and pair assignments provided automatically when service order is entered.
 13. Provide equipment inventory list containing the following minimum requirements:
 - a. CSU cabinets, cards (active and spares), batteries, current and surge protectors, rectifiers, peripheral equipment (i.e. public address, radio page, etc.).
 - b. Quantity of single and multi-line telephones, speakerphones, dial intercom units, speakers, gongs, loud horns, bells, chimes, recorders, etc.

- c. A list of equipment as being used or spare; ordered or received; installed date, warranty date, cost, location, serial number, etc.
14. Electrical or electronic supervisory alarms and faults reports.
- F. 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 INSTALLATIONS, must include the following:
- 1. Connector panels made of flat smooth 3.175 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in the cabinet.
 - 2. Bulkhead equipment connectors mounted on the panel to enable cabinet equipment's signal, control, and coaxial cables to be connected through the panel.
 - 3. Each panel color matching cabinet installed.
- G. Voice:
- 1. 110-type punch blocks certified for category six represent the minimum requirement for voice, and control wiring instead of patch panels. Category six 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 with OEM recommendation and as accepted by COR. Punch blocks will not be permitted 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.
- H. Fiber Optic and Analog Audio:
- 1. Product reference type is 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 (3-1/2 inches).
 - b. Width: Minimum 484 mm (19-1/16 inches), EIA.

- c. Number of Connections: Minimum 12 pairs.
- d. Connectors:
 - 1) 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).
 - 2) 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).
 - 3) Low Voltage Power (Class II): Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted.
 - 4) Fiber Optic: "LC" Stainless steel, female.

I. Mounting Strips and Blocks:

1. Barrier Strips:

- a. Barrier strips must be approved 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 the 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.
- f. Solderless Connectors: Crimp-on insulated lug to fit 6-32 minimum screw terminal. Install fork connector using standard crimp tool.
- g. Furnish items for balancing and minimizing interference capable of passing telephone signals in the frequency bands selected, in directions specified, with low loss, and high isolation and with minimum delay of specified frequencies and signals.

J. System Instruments:

1. Provide system 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 instruments within facility.
2. Provide station equipment consisting of standard single line instruments, patient bedside instruments, and multi-line digital electronic system instruments with digital display, of latest state-of-the-art design.
3. Provide system 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 distinct from hook-switch.
4. Attach laminated faceplate listing the most common user features and their appropriate access codes to system 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 the housing at time of system set installation.
5. Provide station instruments with transmission characteristics compatible with proposed system.
6. Provide system 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, Digital and Electronic Instruments - Features:
 - a. Digital read-out display and with less than 14 programmable (lines or features) buttons.
 - b. Adjustable ringer, bell, buzzer, chime or 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 a means of announcing calls to offices with extensions or pickups on system. Identify provision of intercom systems during data base survey required and provide any required intercom systems.
 - g. Equipment must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment. The use of analog switch ports to provide ringing voltage, if required, is acceptable and include these switch ports in specified equipped capacity.
 - h. Provide hot line telephones between two identified points provided 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, the far-end telephone rings until the hand set is removed from hook-switch.
 - i. Configure speaker on hands free system 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.

2.3 // AUXILIARY SYSTEMS //

- A. //Provide CSU/DSU compatible with system providing a minimum six interfaces with Radio Paging System identified in Section 27 32 41, TWO-WAY RADIO EQUIPMENT, and with technical instructions from COR. If system is not interfaced with a radio paging system, include with CSU/DSU the capability of performing this function. Provide a feature to prevent radio paging system from being "locked up" by a user or an

operator putting system on hold or leaving the receiver "off-hook". Coordinate with radio paging company and Government to identify interface requirements of system. Test during non-working hours at least 30 days before cutover. Provide and install any required peripheral interface device. Notify Government to provide the interface device if it is a card or option in radio paging equipment. //

- B. //Provide CSU/DSU compatible with system that is interfaced to Public Address System (PA) identified in Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS, and with technical instructions from COR. If system is not interfaced with a PA system, CSU must be capable of performing this function.//
- C. Provide console attendants direct access to selected zones and all zones paging. Provide attendant "priority access" to all zones. Provide selected station users access to appropriate zones, by dialing the proper access. Provide required interface devices to PA. Provide a feature to prevent PA from being "locked up" by a user placing system on hold or leaving the receiver "off-hook". //
- D. //Provide SMS connections and compatible system operation as specified by Section 28 52 31, EMERGENCY CALL SYSTEM and Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.//

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install system according to this section and the following:
 1. NFPA 70, National Electrical Code (NEC), Article 517, Chapter 7, and Chapter 9.
 2. NFPA 99, Health Care Facilities, Chapters 3, and 4.
 3. NFPA 101, Life Safety Code, Chapters 7, 12, and 13.
 4. Joint Commission/NFPA Life Safety Book for Health Care Organizations (June 2013).
 5. OEM recommendations and instructions, when more stringent than requirements of this section.
- B. System Installation:
 1. Ensure that installation personnel understand requirements of this specification.
 2. Install filters, traps, directional couplers, splitters, system outlets, and pads for minimizing interference and for balancing amplifiers and distribution systems.

3. Connect passive equipment according to OEM specifications to insure correct termination, isolation, impedance match and signal level balance at each system outlet.
4. Install one outlet for each instrument where TCOs are installed adjacent to each other.
5. Terminate lines in a suitable manner to facilitate future expansion of system. Provide a minimum of one spare 25 pair cable at each distribution point on each floor.
6. Terminate vertical and horizontal copper and fiber optic //, and coaxial // lines in CSU / DSU, TER, MCR and TR equipment only.
7. Install terminating resistors or devices on unused branches, outlets, and equipment ports of system designed for the purpose of terminating fiber optic or twisted pair // , and coaxial // cables carrying system //, and analog video// signals in system // , and analog // systems.
8. Install equipment outdoors in weatherproof enclosures with hinged doors and locks if equipment is not weatherproof. Provide minimum two keys for each lock.
9. Install equipment indoors in metal cabinets with hinged doors and locks. Provide minimum two keys for each lock and VA Police Access Control System.

C. Rack and Cabinet Equipment Mounting:

1. Install rack mount equipment on enclosures' 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 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, system, control, etc.) so that outputs from each source, device or system component enters panel at top row of jacks, beginning left to right as viewed from front; designate these as "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; designate these as "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 allow 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.
10. Install a quad outlet with modular jacks and stainless steel face plate for each system outlet. Provide appropriate modular jack (single or quad) with appropriate face plate for each 'outlet' location identified and verified.
11. Install wall system and pole instruments on a single modular jack designed for wall and pole system instruments and patient wall or PBPU installations.
12. 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.
13. Where cables penetrate fire/smoke partitions, firewalls, or floors, coordinate installation of fire stopping material of type accepted by COR.
14. 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.

15. Run cross connects to established circuits during installation and maintenance service.
 16. Remove debris and scrap generated in conduct of work, on a daily basis.
- D. Installation of Conduit, Cables And Wiring, Cable Tray, Raceways, Signal Ducts:
1. General: 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 system, SMS //, and PA // Systems (as identified by NEC Section 517) are separated and protected from other systems.
 3. Install cable junctions and taps to be accessible. Do not install multi-taps or other distribution equipment items inside cable ducts or raceways. Use minimum 200 mm x 200 mm x 100 mm (8" X 8" X 4") junction box attached to cable duct or raceway for installation of distribution system passive equipment. Ensure equipment and tap junctions are accessible.
 4. Install and fasten cables without causing sharp bends or rubbing of cables against sharp edges. Fasten with hardware that does not damage or distort cables.
 5. Identify cables with permanent labels at terminals of electronic and passive equipment and at each junction point in system. Lettering on cables must correspond with lettering on the record wiring diagrams.
 6. Group cables to not change position throughout cable run.
 7. Test cables after installation and replace any defective cables.

3.2 FIELD QUALITY CONTROL

SPEC WRITER NOTES:

1. If this section is being used in conjunction with specification Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT or Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING the following testing guidelines are in addition to requirements outlined in these documents. If this document is being used as a "Stand Alone" cable plant installation, the following testing guidelines shall be standard of measure for respective system.
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.
 2. Install 50 percent of system extension equipment to include CSU, 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 the contractor expects to be ready for interim inspection, minimum seven working days before requested inspection date.
 4. Furnish results of interim inspection to COR and Project Manager. 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 RE determine if an additional inspection is required, or if contractor will be allowed to proceed with installation. In either case, re-inspection of deficiencies noted during interim inspections, must be part of proof of performance test. 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 the installation of system, pretest entire system.
- C. Pretesting Procedure: During system pretest, verify (utilizing accepted spectrum analyzer and test equipment) that system is fully operational and meets system performance requirements. Measure and record aural carrier levels of each system instrument, at each of the following points in system:
1. Telephone System inputs.
 2. CSU/DSU inputs and outputs.
 3. TER, MCR and TR amplifiers, channel processor and converter inputs and outputs.
 4. CSU/DSU output signal-to-noise ratio for each instrument.
 5. Signal level at each interface point to distribution system, last outlet on each trunk line and outlets installed as part of this project.

6. Submit 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 others specifically identified by COR, and that system complies with documented requirements. Submit notification of system readiness no later than twenty working days prior to beginning of scheduled Government proof of performance test. Failure of contractor to comply with these pretest requirements, automatically cancels 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 30 days written notice prior to date acceptance test is expected to begin; include expected duration of time for test. Test in presence of a COR and OEM certified representative. Test utilizing test equipment to certify proof of performance and Life Safety Compliance. 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 test. Failure of any part of system, that precludes completion of system testing and cannot be repaired within four hours, terminates 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 convenience of Government.
- F. Acceptance Test Procedure:
1. Mechanical and Physical Inspection:
 - a. COR may tour major areas where system and sub-systems are located to ensure they are completely and properly installed in place and are operationally 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 will terminate testing.
2. Sub-system Operational Test:
- a. After mechanical and physical inspection, perform operational test of each sub-system to verify that equipment is connected, interfaced and operational to meet requirements of this section. If any sub-system is not ready, that sub-system will be declared unacceptable and all testing terminated. At this point, Contractor is only permitted one hour to correct deficiencies.
 - b. 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 the convenience of Government.
3. Sub-system Performance Test: After operational test of each sub-system, verify that all performance requirements and standards are met. Verify there are no visible signal distortions, such as intermodulation, beats, etc. appearing on any received or generated system with spectrum analyzer, signal level meter and BERT.
4. Total System Test: Commences after system and sub-systems have been tested and accepted.
- a. Existing System Point of Demarcation: Check system outputs.
 - b. CSU/DSU: Test within 30 days following successful pretesting of CSU/DSU. In addition to compliance with technical characteristics and quantities of equipment specified herein, the final acceptance test provision that 30 continuous days of uninterrupted system service, must be completed prior to Contractor being deemed to be in compliance with contract.
 - 1) For purpose of final acceptance, system 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 term "interrupted service".

- 2) To facilitate CSU/DSU acceptance test and to allow familiarization and training of government employees, activate CSU/DSU, 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 CSU/DSU. Make CSU/DSU available for in-house communications and demonstrate features to facility staff. Government and contractor will ensure trunks // and tie line circuits // are available to CSU/DSU during this "burn-in" period for testing.
 - 3) At conclusion of Acceptance Test, if Project Manager, SMCS and COR agree to the results of the test, reschedule testing on deficiencies and shortages, if any. The 30 days of uninterrupted service provision begins when test shows the system performs in accordance with the specifications. If any retests are needed to reach agreement on the results of tests or to establish compliance with these specifications, such retesting is provided at contractor's expense.
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: To ensure that system meets performance requirements, check a minimum 75 percent of system outlets and interface points. Additionally check each sub-system interface, junction, and connection point or location. 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. Government will reschedule testing on deficiencies and shortages, using generated punch list (or discrepancy list).
 2. If system is declared unacceptable without conditions, retesting is provided at contractor's expense.

3.3 SYSTEM STARTUP

- A. Provide personnel (switch technicians, installers, trainers, and 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 system equipment located in TR and TER to telecommunications grounding busbar.
- C. Provide system ground between CSU/DSU and interfaced systems such as existing SMS, //_____// system, 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 system installation conforms to local building and fire codes.

3.4 TRAINING

- A. Provide services of 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 system and equipment.
- B. Provide services of 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. Group classes when multiple areas are involved. Coordinate periods of training with COR to ensure all shifts receive required training. Include instructions utilizing "hands-on" operation and functions of system.
- C. Before system can be accepted by Government, this training must be accomplished. Schedule training at the convenience of the Facilities Contracting Officer 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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