

(September 2021)

PERFORMANCE CRITERIA
FOR

SECTION 27 32 43

RADIO COMMUNICATIONS EQUIPMENT
09/21

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GENERAL

This Performance Criteria (PC) specifies the installation and quality of radio communications systems and equipment.

Note: A typical Radio Communications System consists of a base station, handheld portable radios, vehicle units, antennas, power supplies, controllers, electrical panels, computers, pagers and other equipment as required. The size, complexity and cost of the systems depend on the geographic region covered, distribution of the facility staff, size and capability of the facility, facility mission and distances to supporting polies, fire and disaster relief organizations. Real property, including raceway, cable tray, junction boxes, etc. are not included in this criterion.

1.1 REFERENCES

1.1.1 Unified Facilities Criteria (UFC)

Contractor must comply with the following:

- A. UFC 1-200-01 General Building Requirements
- B. UFC 3-501-01 Electrical Engineering
- C. UFC 3-580-01 Telecom Building Cabling Systems Planning and Design
- D. UFC 4-010-06 Cybersecurity
- E. UFC 4-510-01 Military Medical Facilities

1.1.2 Military Standard

- A. MIL-STD 1691 Construction and Material Schedule for Medical, Dental, Veterinary and Medical Research Laboratories

1.1.3 National Fire Protection Association (NFPA)

- A. NFPA 99 Healthcare Facilities Code
- B. NFPA 101 Life Safety Code

1.1.4 Military Health System Standards

- A. Defense Health Agency Standards
 - 1. Building Control Systems Categorization Memorandum
 - 2. Cyber Security Controls for Physically Isolated Systems
 - 3. Cyber Security Controls for Medical Community of Interest (MEDCOI)
- B. Department of Defense Standards

1. Department of Defense Instruction (DoDI) Number 8500.01
2. Department of Defense Instruction (DoDI) Number 8510.01
3. Department of Defense Instruction (DoDI) Number 8530.01

1.1.5 Federal Communications Commission (FCC)

- A. FCC Approved RF Communicating Device

1.1.6 Other Standards

- A. Reserved for future

2.1 DESCRIPTION & MATERIALS

2.1.1 General

- A. Furnish and install a complete and fully operational two-way radio repeater system. Include all amplifiers, power supplies, cables, outlets, attenuators, antennas, towers and other parts necessary for the reception, transmission and distribution of the off-the-air VA licensed or approved radio signals.
- B. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- C. Expansion Capability: Increase number of stations in the future by [____] percent above those indicated without adding any internal or external components or main antenna or trunk cable conductors.
- D. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- E. Meet all FCC requirements regarding low radiation and/or interference of RF signal(s). The system must be designed to prevent direct pickup of signals from the building structure.
- F. System must interface with police, fire and disaster relief organizations dispatch systems.
- G. Weather-Resistant Equipment: Listed and labeled by an OSHA certified National Recognized Testing Laboratory (NRTL – i.e. UL, CSA, ETL, etc.) for duty outdoors or in damp locations.
- H. Provide cabling and other balance of system components in accordance with the manufacturer's recommendations and UFGS 27 10 00 – Building Telecommunications Cabling System.
- I. [System must interface with Public Address system.]

2.1.2 System Description

M4125 – Radio Communications Equipment

- A. The Contractor is responsible for interfacing the telephone [, and _____] systems with the system.
- B. The two-way radio system is defined as Emergency Service by NFPA (re Part 1.1.A) and so evaluated by TJC.
- C. The Contractor must continually employ interfacing methods that are approved by the OEM. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels about signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.
- D. It is not acceptable to utilize the telephone cable system for the control of radio signals and equipment. The System Contractor must connect the Telephone System Remote Control System to the Radio System Paging Control Unit ensuring that all NFPA and Underwriters Laboratory, Inc. (UL) Critical Care and Life Safety Circuit and System separation guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. The Owner must arrange for the interconnection between the Two-Way Radio and Telephone Systems with the appropriate responsible parties.
- E. All passive distribution equipment must meet or exceed -80 dB radiation shielding criteria and be provided with screw type audio connectors.
- F. All trunk, branch, and interconnecting cables and unused equipment ports or taps must be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.
- G. The system must utilize microprocessor components for all signaling and programming circuits and functions. System program memory must be non-volatile or protected from erasure from power outages for a minimum of 30 minutes.
- H. The system must provide continuous electrical supervision of each RF amplifier, interconnecting trunk and riser cables and UPS to determine change of status and to assist in trouble shooting faults.
- I. Provide a backup battery or a UPS for the system to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.

- J. Plug-in connectors must be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines must use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems must utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.
- K. All equipment faceplates utilized in the system must be stainless steel, anodized aluminum or UL approved cyclic plastic for the areas where provided.
- L. Noise filters and surge protectors must be provided for each equipment interface cabinet, head-end cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.
- M. Audio Level Processing: The control equipment must consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each sub-zone in the system and distribute them into the system's RF interfacing distribution trunks and amplification circuits. It is unacceptable to use identified Telephone System cable pairs designated for Two-Way Radio interface and control use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor. The use of telephone cable to distribute RF signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location must be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified.
- N. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities must be as indicated.

2.1.3 Manufacturers

- A. The products specified must be new, FCC and UL Listed, and produced by OEM manufacturer of record. An OEM of record must be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
 1. Maintains a stock of replacement parts for the item submitted,
 2. Maintains engineering drawings, criteria, and operating manuals for the items submitted, and
 3. Has published and distributed descriptive literature and equipment criteria on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
- B. Criteria contained herein as set forth in this document detail the salient operating and performance characteristics of equipment to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a criterion contained herein, the item of equipment offered or furnished must meet or exceed the criteria for that item of equipment.
- C. The equipment items are the salient requirements to provide an acceptable system described herein.

2.1.4 Products

- A. Control Console: A console must be provided in the Police Operations Room, Disaster Control Room, Service, Engineering Service, MAS [and _____ location(s)] and as shown on the drawings. The console must contain visual enunciators for each control function that visually display the system function used and/or in use by microphone(s) and telephone(s).
- B. Local radio paging consoles and/or remote-control units must be provided in the following locations and/or other designated 24 hour a day facility operational area for facility wide only code one (blue) paging function and as shown on the drawings:
 1. Telephone Operator.
 2. Security Service Command Console.
 3. [_____.]
- C. Local radio paging consoles and/or remote-control units must be provided in the following locations area for Facility wide routine two-way radio and radio paging functions and as shown on the drawings:
 1. Telephone Operator.
 2. Security Service Command Console.
 3. Engineering Service.
 4. MAS.
 5. [_____.]
- D. Each floor and/or office control and interface system must be provided in a "buss" design where each location's and/or floor's radio control console and/or control equipment is fed from centrally located (usually in the corridor) lateral trunk-

- line cables. Each signal closet must contain a minimum of one terminal cabinet capable of connection to vertical trunk-line riser cables to lateral trunk-line cables in the associated signal closet and as shown on the drawings or recommended by the OEM.
- E. Head-end Cabinet Location:** The head-end equipment must be provided, protected, and located in a cabinet adjacent to the [_____] equipment in the _____ Room [other _____] as close as possible to the antenna location and as shown on the drawings. The cabinet must be provided and protected at this location to insure optimum origination, reception, and control of all system signals. Each cabinet must be provided with an internal active 120 Volts Alternating Current (VAC) quad receptacle connected by conduit to the Facility's Critical Branch Emergency Power distribution panel designated by the Resident Engineer. Each cabinet must be provided with a minimum of two feet or clearance from all obstructions in the signal closet where located. Each cabinet must be provided as required to meet the single audio channel requirements and system performance standards.
- F. Interface Cabinet Location:** Provide the cabinet in [_____] and as shown on the drawings. Connect 120 VAC quad receptacles to the Facility's Critical Branch Emergency Power AC distribution panel as designated by the RE.
- G. Operator Control Console Location:** Provide the cabinet in [_____] and as shown on the drawings. Connect 120 VAC quad receptacles to the Facility's Critical Branch Emergency Power AC distribution panel as designated by the RE.
- H. Antenna Equipment:**
1. Guyed and Free-Standing Towers: The contractor must forward two copies of the report to owner for technical review.
 2. Ground Type Installations: The antenna site must be protected from accidental intrusion by station personnel or patients. The ground protection design must be enough in scope to secure the entire antenna area by a chain link fence and gate with lock and key. Wood fences are not acceptable.
 3. Technical Characteristics:
 - a) Radio Frequency Interference (RFI): None measurable
 - b) Construction: 3 meters (10 foot) high, rust proof with 1.2 meters (4 foot) wide gate
 - c) Securing: Lock with two sets of keys for the gate.
- I. Nitrogen Tank:** Nitrogen tank(s) must be secured, pressurized and full. All required valves, transmission line connections and gauges must be furnished and properly installed. The tank(s) must be 6.3 m² (226 Cubic Foot) "K" size, with a charge of 998 kg per cm² (2,200 pounds per square inch). A protective cover or enclosure must be furnished and installed by the Contractor to secure all valves and controls. Provide one spare full tank.
- J. RF Transmission Line:**
1. Spiral: The provided transmission line must be coaxial, jacketed with fire resistant material when run outside of conduit and/or cable tray, or as required by system design, and pressurized to the OEM's criteria.
 - a. The cable must be as specified by the OEM. If not specified by the OEM, it must be provided with the proper impedance, be double shielded, and contain other characteristics to satisfy all equipment and system requirements. The cable must meet the following criteria
 - b. Technical Characteristics:
 - 1) Outside Diameter: 13mm (0.5 inch), maximum
 - 2) Center Conductor: Solid copper, silver coated
 - 3) Insulation: Polyethylene with air passages
 - 4) Jacket: Teflon or Kynar (when required)
 - c. Attenuation:
 - 1) Frequency (MHz): Attn/dB per 100 ft
 - 2) 100: 2.5
 - 3) 200: 3.5
 - 4) 400: 5.0
 - 5) 890: 8.0
 2. Feed Through: A feed through must be provided for all penetrations of exterior building walls or roofs. The feed through(s) must be waterproof, sleeved, and OEM recommended, and Resident Engineer approved for the system.
 3. Humidity Protection: At a minimum, the interior of all transmission lines must be protected from the infiltration of moisture or water as follows:
 - a. Nitrogen Tank: Nitrogen tank(s) must be secured, pressurized and full. All required valves, transmission line connections and gauges must be furnished and properly installed. The tank(s) must be 6.3 m² (226 cubic foot) "K" size, with a charge of 998 kg per cm² (2,200 pounds per

- square inch). A protective cover or enclosure must be furnished and installed by the Contractor to secure all valves and controls. Provide one spare full tank.
- b. Dry Air: A dry air system is an acceptable alternate for the nitrogen tank. The dry air system must be specifically designed for the installation and as described, recommended by the OEM, mechanically approved by the RE.
4. Lightning Protection System: Each protection system must be provided in its entirety totally and externally to the building. The use of internal electrical grounding systems is not acceptable and will not be approved.
- a. Antenna, Mount, Mast, and Tower: The antenna, antenna mount, tower or mast and transmission line must be grounded with copper wire run external to the building and connected to the earth ground. If the antenna is to be installed in an area not protected by lightning rods or if the antenna is to be elevated above existing lightning rod protection, the Contractor must immediately notify the Resident Engineer in writing regarding the lightning strike hazard.
 - b. Radio Frequency Transmission Line and/or Coaxial Cable Lightning Protector:
 - 1) The protector must be an in-line device equipped with screw type connectors to match the coaxial cable specified. It must be grounded with stranded copper wire run external to the building and connected to the earth ground. It must be able to shunt high current surges to the earth ground protecting the system signal receiving equipment. The protector must have a minimal effect on the quality of the signal being received or transmitted. It must be made of non-corrosive metal and be waterproof.
 - 2) Technical Characteristics:

a. Peak Pulse Power:	1500 w @ 77 degrees F
b. Protection Device:	Gas Tube or as required by OEM
c. Dissipation:	1.0 Millisecond (MS)
d. Response Time:	5.0 NS (Nano seconds)
e. Connectors:	As Specified
f. Ground Wire:	#6 AWG Stranded Copper, minimum, or as required by the OEM, and/or the RE

K. Head-end Equipment:

- 1) Equipment Cabinet:
 - a. Head-end Cabinet Location: The head-end equipment must be provided, protected and located in a cabinet adjacent to the [_____ equipment in the _____ Room] [other _____] as close as possible to the antenna location and as shown on the drawings. The cabinet must be provided and protected at this location to insure optimum origination, reception and control of all system signals. Each cabinet must be provided with a minimum of 610 mm (two feet) or clearance from all obstructions in the signal closet where located. Each cabinet must be provided as required to meet the single audio channel requirements and system performance standards.
 - b. The equipment cabinet must be lockable, heavy gauge steel (16-gauge minimum), iron phosphate treated prior to finishing, with baked on paint finish in a color selected by the Resident Engineer. It must be floor or wall mounted with knock out holes for cable entrance and conduit connection, provided with ventilation ports and quiet fan with non-disposable air filter for equipment cooling. Two keys must be provided for each lock to the Resident Engineer when the system is accepted.
 - c. A minimum of 380 mm (15 inches) of blank front rack space for additional equipment must be provided. Blank panels must be installed to cover any open or unused rack space. One blank 45 mm (1.75 inch) high, blank panel must be installed between each item of equipment.
 - d. Blank panels must be color matched to the cabinet, 3.2 mm (1/8 inch) aluminum with vertical dimensions in increments of 45 mm (1.75 inch) with mounting holes spaced to correspond to EIA/TIA 483 mm (19 inch) dimensions. Single standard size blank panels must be used to fill unused panel or rack spaces in lieu of numerous 45 mm (1.75 inch) types.
 - e. AC Power Outlet Strip(s): A strip must be provided with a grounded outlet for each item of equipment and a minimum of four spare AC power outlets. Each strip must be permanently (cable ties are not acceptable) mounted inside and at the rear of each equipment cabinet. The strip must be self-contained in a metal enclosure with a maximum of a 2 meter (6 foot) connecting wire sized No. 14 AWG with three prong AC power plug, all rated 15A at 120V. Extension or "pig tail" non-protected cords from the system cabinet or rack to each system wall outlet is not authorized and

must not be allowed and if discovered must be grounds to declare the entire system unacceptable and terminate all acceptance testing.

- f. AC Power Line Surge Protector and Filter:
 - 1) Each cabinet containing active electronic equipment must be equipped with an AC Surge Protector and Filter. The Protector and Filter must be housed in one single enclosure. The Protector and Filter must provide instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. It must be cabinet mounted and the cabinet's AC power strip (two strips maximum) may be connected to it.
 - 2) Technical Characteristics:
 - a. Input Voltage Range: 120 VAC + 15%
 - b. Power Capacity: 15 AMP, 120 VAC
 - c. Voltage Output Regulation: +3.0%
 - d. Circuit Breaker: 15 AMP, May be self-contained
 - e. Noise Filtering: Greater than 45 dB
 - f. AC Outlets: Four duplex grounded types, minimum
 - g. Response Time: 5.0 Nano Seconds (ns)
 - h. Surge Suppression: 10,000 AMPS
 - i. Noise Suppression: -40 dB Common, -45 dB Differential
- g. Audio Monitor Panel:
 - 1) The panel must be EIA/TIA standard for 483 mm (19 inch) cabinet mounting. It must be provided in the upper portion of the head-end equipment cabinet.
 - 2) Technical Characteristics:
 - a. Monitor Speaker: A permanent magnet, 76 mm (3 inch) minimum diameter, and a monitor volume control.
 - b. Audio Meter: 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 must connect the monitor Speaker and VU meter to the selected Audio channel.
- h. Trouble Annunciator Panel:
 - 1) A trouble annunciator panel must be provided in the head-end cabinet and Telephone Operator, [and _____] locations and as designated on the contract drawings. The panel must be compatible with or generate electrical and/or electronic supervising signals to monitor continuously the operating condition for the system head-end audio power amplifier(s), remote power amplifier(s), and interconnecting trunks. The panel must generate an audible and visual signal when the system's supervising system detects an amplifier or trunk line is malfunctioning. Provide one spare panel.
 - 2) Technical Characteristics:
 - a. Silence Button or Switch: Must silence the audible signal. However, the visual signal will continue until the supervisory circuit indicates the fault is corrected.
 - b. Visual Enunciators: Visually show the amplifier and/or trunk-line unit or supervisory circuit is in fault condition.

L. Radio Terminals:

- 1) General: The radio terminal must be analog, amplitude (AM) or frequency (FM) modulated, cabinet mounted, and modular constructed. It must be designed to operate in the specified Government Protected RF Bands and must conform to Narrow Band Operation. The terminal must have built-in test points and metering to measure the principle operating functions and power supply voltages without disrupting service. Provide one spare set of modules and power tubes.

- 2) Radio Paging Terminal: The radio paging terminal must be redundant, hot standby, provided with UPS, and be fully electrically supervised.

M. Audio Power Amplifier:

- 1) The amplifier(s) must have a minimum of two input channels, each with bridge output circuitry and bridge or parallel single channel inputs. Each output must be capable of providing a 70.7V “constant voltage” audio line. Each output channel must be selectable between eight Ohms and 70.7V modes. The Amplifier circuit components and load must be fully protected from input overdrive, mismatching, or shorting failure. Input controls must be lockable and fixed. Provide one spare amplifier.
- 2) Technical Characteristics:
 - a. Frequency Response: 45 to 15,000 Hz + 1.0 dB, minimum
 - b. Max Hum and Noise: 80 dB Below Rated Output, minimum
 - c. Rated Output: Minimum of 125% consumed by associated speakers, 35 watts minimum required.
 - d. Input for Rated Output: 0.8 V for rated output
 - e. Total Harmonic Distortion (THD): 0.5% maximum rated output.
 - f. Output Level: 8 Ohms and 70.7 V options on the power amplifier
 - g. Regulation: Required
 - h. Electrical Supervision: Required for each amplifier to report fault indications that include: input AC power failure, PA amplifier output failure, and internal PA amplifier DC power supply failure.
 - i. “On/OFF” Switch with Pilot Light: Required
 - j. Master Gain Control: Required
 - k. Input Level Adjustment: Required, for each input
 - l. AC Input Circuit Protection: Required, short circuit protected
 - m. Extra Cooling: Required, internal variable speed fan

2.1.5 Remote Control Equipment

A. Operator Control Console Location: Each console must be provided, protected and located in the respective service area (i.e. Telephone Operator, Security, Engineering, MAS, etc.) to insure optimum origination, reception and control of all system signals. Each console must be provided with an external active 120 VAC quad receptacle. Each console must be provided with a minimum of 305 mm (one foot) of clearance from all obstructions in the area where located. Each console must be provided as required to meet the single audio channel requirements and system performance standards.

B. Microphone Paging Console:

- 1) A console must be provided in the Telephone Switchboard Room or Telephone Operator [, and _____] location(s) and as shown on the drawings. The console must contain visual enunciators for each zone, which must visually display the system zones in use by microphone(s) and designated telephone(s). Provide one spare console and microphone.
- 2) Technical Characteristics:
 - a. Microphone:
 1. ON OFF Switch: Required
 2. Impedance Matching Device: Required, multiple tap type
 3. Impedance: Low (150 Ohms minimum), balanced
 4. Type: Omni-direction, dynamic type
 5. Frequency Range: 60 - 10 kHz, minimum
 6. Output Audio Signal Level: -52.0 dB, minimum
 7. Nominal Weight: 1.36 kg (3 pounds), minimum
 - b. Console:
 1. Switches or Push-Buttons: Required, to select any single sub-system and/or all sub-systems simultaneously. Additionally, a separate switch or push-button must be provided for the ALL CALL function that immediately overrides all paging calls in every zone and sub zone.
 2. Mounting: Desk top or cabinet
 3. Construction: Metal constructed as described for the head-end

cabinet (may be custom designed by the Contractor if approved by the RE)
Required

4. UPS and/or Battery Backup: Required
- c. Radio Control Console:
 1. A console must be provided in the Security Service Control Room, Engineering Service Room [_____], MAS Room [_____], and [_____] location(s) and as shown on the drawings. The console must contain visual enunciators for each zone, which must visually display the system zones in use by microphone(s), designated telephone(s), and other radio systems. Provide one spare console and microphone.
 2. Technical Characteristics:
 - a. Microphone:
 1. ON OFF Switch: Required
 2. Impedance Matching Device: Required, multiple tap type
 3. Impedance: Low (150 Ohms minimum), Balanced
 4. Type: Omni-direction, dynamic, flexible arm type
 5. Frequency Range: 60 - 10 kHz, minimum
 6. Output Audio Signal Level: -52.0 dB, minimum
 7. Nominal Weight: 1.36 kg (3 pounds), minimum
 - b. Console:
 1. Switches or Push-Buttons: Required, to select any sub system and/or all sub systems simultaneously. Additionally, a separate switch or push-button must be provided for the ALL CALL function that immediately overrides all paging calls in every sub system.
 2. Mounting: Desk top or cabinet
 3. Construction: Metal constructed as described for the head-end cabinet (may be custom designed by the Contractor if approved by the RE)
 4. UPS and/or Battery Backup: Required
- d. Telephone Paging Adapter:
 1. The Facility's Telephone Maintenance Contractor or local telephone company must be consulted by the Contractor where the Contractor must provide and install a paging adapter for each zone and sub-zone designed for use with the Facility's telephone system. The adapter(s) must operate from telephone number access provided by the Facility's Telephone Contractor. Note: This unit may contain the Time Out Device identified in paragraph 2.4.D. Provide one spare set of electronic cards and/or modules.
 2. Technical Characteristics:
 - a. Frequency Response: 200 to 7.0 kHz, minimum
 - b. Input Impedance: 600 Ohms, balanced or must match the telephone company lines & VAMC telephone system.
 - c. UPS and/or Battery Backup: Required
- e. Time Out Device: A time out device must be provided to prevent system "hang-up" due to an off-hook telephone. The device must be able to be preset from 30 seconds to two minutes. Its function must not interfere with or override the required all call operational capability. Note: This device may be combined with the Paging Adapter identified in paragraph 2.4.C.

- f. Volume Limiter and/or Compressor:
1. Each unit must provide a constant input to each audio power amplifier where used in the system. At a minimum, each operable and spare zone must be equipped with a limiter/compressor installed in the head-end cabinet. The unit must compensate for the different input volumes to provide a constant level regardless of which audio input source is used. Each audio input and output impedance must match the telephone and microphone inputs, audio power amplifiers, and any associated equipment. It may be incorporated as a part of the equipment identified in paragraph 2.4.C. Provide one spare limiter and/or compressor.
 2. Technical Characteristics:
 - a. Frequency response: 45 - 15 kHz, + 1.0 dB minimum
 - b. Signal Reduction Ratio: 10 to 1 and 5 to 1, selectable
 - c. Total Harmonic Distortion: <1.0 percent
 - d. Output Level: +14.0 dBm, minimum
 - e. Inputs: Two minimum, each must be equipped with a variable front panel gain control and VU or dB meter for adjustment
- g. Audio Mixer:
1. The mixer must contain multiple input/preamplifiers providing automatic attenuation of unused or inactive inputs. Adjustable gain reduction must be from zero to +20 Log Nominal dB (0 - +6dB) at each output doubling of simultaneously active inputs. It may be incorporated as a part of the equipment identified in paragraph 2.4.C. Provide one spare mixer.
 2. Technical Characteristics:
 - a. Frequency Range: 20 Hz -20 kHz, minimum.
 - b. Distortion: 0.1 percent, at 1 kHz test tone
 - c. S/N: 70 dB with the band pass, input volume minimum and main volume maximum
 - d. Inputs:
 1. Number: Four, minimum, electronically balanced
 2. Impedance: 150 - 600 Ohms balanced, selectable
 3. Level: +15.0 dBmV, maximum
 - e. Outputs:
 1. Main: [_____]
 2. Impedance: 600 and 150 Ohms, selectable, electronically balanced
 3. Isolation: Transformer provided
 - f. Direct:
 1. Number: One per channel
 2. Impedance: 450 - 680 Ohms, balanced
 - g. Security Cover: Required, must restrict access to all controls, but allows viewing of various lights or LED's
 - h. Signal Indicators: VU analog meter or LED for each input and output
 - i. Connectors: "XL" or "Phone Jack"

2.1.6 Wireless

A. Radio Paging Equipment and Systems:

- 1) The radio paging system must be Certified and Licensed system (FCC Part 15 listed pagers and transmitters are not allowed for "Safety of Life" functions or installed in those specific areas – ONLY approving authorities for this function) and must have the following minimum system features:
 - a. Ability to pass-through location information (such as a room number) and call-type as well as other text messages simultaneously to shift supervisor identified staff members
 - b. Ability to allow the operator to select staff members by name and pager number and to select a message consisting of a room number and a condition code (aka priority level). Operator may

also choose to type in a unique alpha-numeric text message (the text message must meet or exceed all HIPA and OCIS Communications Security Guidelines for the transmission of Patient or Staff Specific information (aka PII) – Headquarters TVE - 005OP2B is the approving authority for this function) into the system to be read by the holder of the pager unit.

c. While a patient station is connected to the nurse's master station, the radio paging system must allow the operator to automatically page a staff member assigned in that area / room. An alternate staff member may be selected for paging purposes in place of the primary staff member. The radio paging system must allow an alternate staff member to be paged when the primary staff member is unable to respond to patient's needs within a specified period. The radio paging system must have the ability to assign any pager or pager group, and to assign an unlimited number of pagers to any location.

2) The radio paging system must have the ability to send all code blue calls to staff members by predetermined group (as required or aka 'ALL CALL') automatically by simply pressing one "Code Blue" button. The Code Blue Pager must indicate room number of code call, and state "Code Blue" in plain English format on pagers (FCC Part 15 listed pagers are not allowed to be use as "Safety of Life" functions or those specific locations – Headquarters TVE - 005OP2B is the approving authority for this requirement).

B. Personal Wireless Communicator (PWC):

1) The radio paging system will only be allowed to connect to the personal wireless communications system, pass text data and provide a 2-way communication between the Telephone Interface and the personal wireless communicator as long as it is not a FCC Part 15 listed device(s), meets or exceeds UL 60950-1/2, meets OCIS Guide Lines for FIPS 140-2 certification and the using staff shows an extensive training program along with recertification(s) according to the Facility Emergency Plan concerning HIPA requirements.

2) Headquarters TVE - 005OP3B and SM - 005OP2B are the approving authority for this requirement.

C. Other Wireless Equipment and Systems:

1) Each proposed wireless system and/or equipment to be connected to or be a part of the PAS system, each must meet the minimum requirements.

2) Contact TVE - 005OP3B and SM – 005OP2B for specific required preapprovals (full or conditional) as described herein.

2.1.7 Distribution Equipment

A. Audio Power Amplifier: Refer to the amplifier characteristics in paragraph 2.2.C. for each amplifier used in the distribution system. Provide one spare amplifier in addition to the spare head-end amplifier.

B. RF Distribution and/or Power Amplifier: The amplifier must perform the necessary RF signal amplification to allow the system to operate within its described performance standards. It must be mounted within a distribution cabinet and provided with an UPS or battery back up in locations selected by the Contractor and approved by the OEM. Provide one spare amplifier.

C. Distribution System Cabinets: The cabinet must have the same technical characteristics as the head-end cabinet and may be wall mounted type with control knobs.

1) Distribution and/or System Interface Cabinet:

a. The cabinet(s) must have hinged front and rear (front door only if wall mounted) doors. Each cabinet must be wall mounted and may be floor mounted per system design and OEM recommendation.

b. Technical Characteristics:

1. Overall Height:	2181 mm (85 7/8"), maximum
2. Overall Depth:	648 mm (25 1/2"), maximum
3. Overall Width:	535 mm (21 1/16"), maximum
4. Vertical Mounting Space:	1959 mm (77 1/8"), maximum
5. Front Panel Horizontal Width:	484 mm (19 1/16"), EIA horizontal maximum
6. Hole Spacing:	EIA

2) Equipment Breakout or Termination Connector Panel:

a. The connector panel must be made of flat smooth 3.2 mm (1/8 inch) thick solid aluminum, custom designed, fitted, and installed in the cabinet. Bulkhead equipment connectors must be mounted on the panel to enable all cabinet equipment's signal, control, and coaxial cables to be connected through the panel. Each panel must be color matched to the cabinet installed.

b. Technical Characteristics: Product reference or Government Approved (US State Department) manufacturer is Tele wire, CATV Division, PUP-17 with F-81D connectors installed. This panel

may be used for RF, fiber-optic, video, audio, and control cable installations when provided with the proper connectors. This panel is not allowed to be used for 120 VAC power connections.

- c. Size:
 - 1. Height: 88.9 mm (3.5"), minimum
 - 2. Width: 484 mm (19 1/16"), EIA minimum
 - 3. Number of Connections: 12 pairs (or sets), minimum
- d. Connectors:
 - 1. RF: "F81D"
 - 2. Audio: 6.35 mm (1/4") Phono, XLR, or RCA (Barrier strips, surface mounted with spade lugs, punch block or wire wrap type strips are acceptable alternates)
 - 3. Control: Barrier strips surface mounted with spade lugs, punch block or wire wrap type strips
 - 4. Low Voltage Power (Class II): Barrier strips with spade lugs and plastic cover, surfaced mounted
 - 5. Fiber-Optic: "ST" Stainless steel, female

3) Junction Boxes:

- a. Junction box(s) must be flush or surface mounted and installed at least 457 mm (18 inch) above a finished floor for main room interconnection or above dropped ceilings anywhere in the system. If the dropped ceiling is rigid, the Contractor must provide an access door or other approved means in the ceiling to allow easy access to the junction box.
- b. Junction boxes containing system active electronic equipment must be additionally provided with quiet fan and non-disposable air filter, hinged doors and locks keyed alike with two keys. Universal lock keying of each system enclosure is acceptable. Junction boxes containing system passive equipment are allowed to be provided with an approved tamperproof full-size front cover as an alternate to the hinged doors with locks and keys.
- c. External conduit(s) must be provided and installed by the Contractor between each junction box and enclosure to allow interconnection and protection of all signal, control and power wires or cables.

D. System Cables: Each cable must meet or exceed the criteria listed below for each identified cable. Additionally, the Contractor must provide a 610 mm (2 foot) sample of each CFE provided cable and OEM cable 100 percent sweep certification tags from each cable reel to the Resident Engineer and receive approval in writing before installation. Each cable must have a Temperature Rating of +80 degrees Centigrade(C) (+176? F). Provide all partially used reels of system reels of cable to the Resident Engineer to be counted as spare units.

1. Radio:

a. RG-214/U and/or RG-8/U Type:

- 1. The cable between radio equipment in the head-end and major distribution trunk lines must be coaxial double shield type. The cable must meet the following criteria.
- 2. Technical Characteristics:
 - a. Impedance: 52 Ohm
 - b. Center Conductor: 14 AWG Solid Copper or Copper Clad
 - c. Dielectric: Polyethylene
 - d. Jacket: Polyethylene (Teflon or Kynar as required)
- 3. Attenuation:
 - a. Frequency (MHz): Attn./dB per 100 ft
 - b. 7: 0.31
 - c. 54: 1.10
 - d. 216: 2.40
 - e. 470: 3.8
 - f. 890: 5.6

b. RG-58/U:

- 1. The cable must be double shielded coaxial type. The cable must meet the following criteria.
- 2. Technical Characteristics:
 - a. Impedance: 52 Ohm

- b. Center Conductor: 20 AWG Solid Copper or Copper Clad
 - c. Shields: Two
 - d. Dielectric: Foam
 - e. Jacket: Polyethylene (Teflon or Kynar as required)
 - 3. Attenuation:
 - a. Frequency (MHz): Attn./dB per 100 ft
 - b. 7: 0.6
 - c. 54: 1.8
 - d. 216: 3.5
 - e. 470: 4.7
 - f. 890: 7.0
- c. Audio:
 - a. Microphone or Line Level:
 - a. Audio cable must be two conductors, shielded cable with stranded conductors and polyethylene insulated.
 - b. Technical Characteristics:
 - 1. Wire Size: 20 AWG
 - 2. Working Shield: 350 V
 - 3. Shield Coverage: 100 percent
 - 4. No of Pairs: At least two individually shielded with separate ground drain wire
 - 5. Jacket: Polyethylene (Teflon or Kynar as recommended by the OEM)
 - b. Loudspeaker:
 - a. Audio cable must be two conductors with stranded conductors and polyethylene insulated. The cable must be able to handle the power and voltage used for the load impedance over the distance(s) required, with not more than 5 percent power loss.
 - b. Technical Characteristics:
 - 1. Wire Size: 16 AWG
 - 2. Working Voltage: 350 V
 - 3. Shield: As required, with separate drain wire
 - 4. No of Pairs: At least two
 - 5. Jacket: Polyethylene (Teflon or Kynar as recommended by the OEM)
 - c. Voice and Control: Voice and control cable must be as specified by the radio OEM. If it is not specified by the equipment OEM, it must be at least 20 gauge solid or stranded copper wire with aluminum foil individually shielded pairs. Its jacket must be polyethylene (or Teflon or Kynar) as recommended by the OEM.

E. System Connectors:

- 1) General: Each connector must be designed for the specific size and type of cable being used and be installed with the OEM's approved installation tool. Typical system cable connectors include, but, are not limited to: UHF, N, F, BNC, KS, XL(R), RCA, Phono Plug, and Forked Connectors (or Audio Spade Lug type) with Barrier Strips. Provide all partially opened boxed of system connectors to the Resident Engineer to be counted as spare units.
- 2) RF Types: These connectors must be connected to provide the following polarity: Center wire --Signal or positive (+); First Shield -- Common or neutral; and Second shield (if provided) -- Ground or return:
 - a. "UHF" Type:
 1. The connector must have screw type coupling for quick connect and disconnect of coaxial cable terminations. It must be a crimp-on connector designed to fit the coaxial cable furnished.
 2. Technical Characteristics:
 - a. Impedance: 52 Ohms
 - b. Working Voltage: 500 V
 - b. "N" Type:

1. The connector must have a bayonet locking coupling for quick connect and disconnect of coaxial cable terminations. It must be a crimp-on connector designed to fit the coaxial cable furnished.
2. Technical Characteristics:
 - a. Impedance: 50 Ohms
 - b. Working Voltage: 500 V
- c. "BNC Type":
 1. The connector must have a bayonet locking coupling for quick connect and disconnect of coaxial cable terminations. It must be a crimp-on connector designed to fit the coaxial cable furnished.
 2. Technical Characteristics:
 - a. Impedance: 52 Ohms
 - b. Working Voltage: 500 V
- 3) Audio:
 - a. General: Each connector must be installed according to the cable or connector OEM's instructions and use the OEM's approved installation tool. Use the slogan "George Washington Bridge" in determining audio signal polarity. George is the "ground or return" wire; Washington is the "white or signal neutral" wire and Bridge is the "black or signal positive" wire, throughout the system using three conductor type wires. Install the connector's to provide and maintain the following audio signal polarity: XLR type connectors -- Signal or positive conductor is pin 3, common or neutral conductor is pin 2, green, ground or return conductor is pin 1; 6.35 mm (1/4 inch) or 3.2 mm (1/8 inch) Phono Plug and Jacks -- signal or positive conductor is TIP, Common or neutral conductor is RING, Shield, ground, or return conductor is SLEEVE; RCA Phono Plugs and Jacks -- signal or positive conductor is TIP, and shield, neutral or common conductor is SLEEVE.
 - b. Microphone Input "XLR": Female configuration with three pins.
 - c. Microphone Output "A3M": Male configuration with three pins.
 - d. Line Level Input: Female "XLR" type with 3 pins or 6.35 mm (1/4 inch) phone receptacles provided with standard mounting plates.
 - e. Line Level Output: Male "A3M" type with 3 pins or 6.35 mm (1/4 inch) phone plug secured to the audio cable.
- 4) Speaker Line Audio:
 - a. Each connector must be provided according to the cable, transformer or speaker OEM instructions and use the OEM's approved installation tool. Each speaker line must be permanently connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier must use audio spade lugs as described herein. The Contractor must ensure each speaker is properly "phased" and connected in the same manner throughout the system using two conductor type wires.
 - b. Technical Characteristics:
 1. Terminal Size: 6-32, minimum
 2. Wire Size: 20 AWG, minimum
 3. Color Code: One of the conductors must be to aid in establishing speaker signal polarity
 4. Signal Polarity: [_____]
 5. Color Coded Wire: Signal or positive
 6. Non-color-Coded Wire: Common or neutral
 7. Shield (if provided) Ground or return
- 5) Wire:
 - a. AC wiring must conform to the following polarity:
 1. Black wire: Hot or positive
 2. White wire: Neutral or common
 3. Green wire: Earth ground
- 6) Terminal Strips and Wiring Blocks: Provide all partially opened boxes of terminal strips or blocks to the Resident Engineer to be counted as spare units.
 - a. Barrier Strips:
 1. Barrier strips are required for AC power, data, voice and control cable or wires. Barrier strips must accommodate the size and type of audio spade (fork type) lugs used with

insulating and separating strips between the terminals for securing separate wires in a neat and orderly fashion. Each cable or wire end must be provided with an audio spade lug, which is connected to an individual screw terminal on the barrier strip. The barrier strips must be surface secured to a console, cabinet, rail, panel, etc. 120 VAC power wires must not be connected to signal barrier strips.

2. Technical Characteristics:

- a. Terminal size: 6-32, minimum
- b. Terminal Amount: Any combination
- c. Wire Size: 20 AWG, minimum
- d. Voltage rating: 100V, minimum
- e. Protective Connector Cover: Required for Class II and 120 VAC power connections

- b. Wiring Blocks: Industry Standard Type 110 Category 5 Rated wiring blocks, are approved for data, voice and control wiring. Wiring blocks must be specifically designed for the size and type of wire used. Designation strips must be secured to a console, cabinet, rail, panel, etc. Wiring blocks must not be used for Class II or 120 VAC power wiring.

F. System Terminators: All partially opened boxes of terminators must be turned over to the Resident Engineer to be counted as spare units.

1) Coaxial Cable:

- a. These units must be metal housed precision types in the frequency ranges selected. They must be the screw on or bayonet locking types that have low VSWR when installed and the proper impedance to terminate the required system unit.
- b. Technical Characteristics:
 - 1. Impedance: 52 Ohms
 - 2. Working Voltage: As Specified
 - 3. Capabilities: AC or DC Power Blocking, As Specified
 - 4. Security Chain Required

2) Audio Cable:

- a. These units must be metal housed precision types in the frequency ranges selected. They must be as specified by the OEM for the specific cable and/or system installed and the proper impedance to terminate the required system unit.
- b. Technical Characteristics:
 - 1. Impedance: 600 Ohms Balanced, 50K minimum, Unbalanced
 - 2. Working Voltage: As Specified
 - 3. Capabilities: As Specified
 - 4. Security Chain: Required at the direction of the OEM

3) Audio Barrier Strips and/or Wiring Blocks:

- a. These units must be forked precision types for barrier strips and push on type for wiring blocks in the frequency ranges selected. They must be as specified by the OEM for the specific cable and/or system installed and the proper impedance to terminate the required system unit.
- b. Technical Characteristics:
 - 1. Impedance: 600 Ohms Balanced
 - 2. Working Voltage: As Specified
 - 3. Capabilities: As Specified
 - 4. Security Chain: Required at the direction of the OEM

G. Raceways:

- 1) Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 16, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
- 2) Each raceway that is open top, must be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 and 800 to "mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface "drop" type conduit cable feeds.
- 3) Intercommunication system cable infrastructure: EMT above accessible ceilings, 24 inches on center.

H. System Conduits:

- 1) AC Power: The conduit must be a minimum 19 mm (3/4 inch) Outside Diameter (O.D.) Electrical Metallic Tubing (EMT). Master AC power conduit and conduit installation criteria and requirements are given herein.

- 2) Signal: The conduit must be a minimum 25 mm (1.0 inch) O.D. EMT. Master signal conduit and conduit installation criteria and requirements are given herein.

I. Conduit Sleeves:

- 1) The Engineer has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the drawings and has instructed the electrician to provide the sleeves as shown on the drawings.
- 2) While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fire-proofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the engineer must be provided by the cabling contractor.

J. Device Backboxes:

- 1) Furnish to the electrical contractor all backboxes required for the PAS devices.
- 2) The electrical contractor must install the backboxes as well as the system conduit. Coordinate the delivery of the backboxes with the construction schedule.

2.1.8 Uninterruptible Power Supply (UPS)

- A. Provide a backup battery or a UPS for the system to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.
- B. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the head-end location, as long as this function is specifically approved by the Telephone Contractor and the RE.
- C. The Radio Contractor must not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the Resident Engineer.
- D. Provide UPS for all active system components including but not limited to:
 - 1) Radio Base/Repeater Stations.
 - 2) Local/Remote Control Units.
 - 3) Personal Computers (when a part of the systems).
- E. Provide 1 spare UPS unit for each 10 units installed.

2.1.9 Installation Kit

- A. The kit must be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, wiring blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, etc., required to accomplish a neat and secure installation. All wires must terminate in a spade lug and barrier strip, wire wrap terminal or wiring block. Unfinished or unlabeled wire connections must not be allowed. All unused partially opened installation kit boxes, coaxial cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, and physical installation hardware must be turned over to the RE. This is an acceptable alternate to the individual spare equipment requirement if the minimum spare items are provided in this count. The minimum required installation sub-kits are as follows:
- B. System Grounding:
 - 1) The grounding kit must include all cable and installation hardware required. All radio equipment must be connected to earth ground via internal building wiring, according to the NEC.
 - 2) This includes, but is not limited to:
 - a. Coaxial Cable Shields
 - b. Control Cable Shields
 - c. Data Cable Shields
 - d. Equipment Racks
 - e. Equipment Cabinets
 - f. Conduits
 - g. Cable Duct
 - h. Cable Trays
 - i. Power Panels
 - j. Connector Panels
- C. Coaxial Cable: The coaxial cable kit must include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
- D. Wire and Cable: The wire and cable kit must include all connectors and terminals, audio spade lugs, barrier straps, wiring blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

- E. Conduit, Cable Duct, and Cable Tray: The kit must include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
- F. Equipment Interface: The equipment kit must include any item or quantity of equipment, cable, mounting hardware and materials needed to interface systems and sub-systems according to the OEM requirements and this document.
- G. Labels: The labeling kit must include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each sub-system according to the OEM requirements, record drawings, and this document.
- H. Documentation: The documentation kit must include any item or quantity of items, computer discs, record drawings, equipment, maintenance, and operation manuals, and OEM materials needed to provide the system documentation completely and correctly as required by this criteria document and explained herein.

2.1.10 System Performance

A. The system must meet the following minimum performance standards

- 1) Radio Standards:
 - a. Emission Designator: 16K00F3E
 - b. Power Output: 100 Watts (W) maximum, or as specified by the Station Operating License(s)
 - c. Operating Frequency: Designated Government Protected Frequencies as appears on the Station Operating License(s)
 - d. Frequency Stability: +0.005 percent
 - e. Signal to Noise (S/N) Ratio: 50.0 decibel measured (dBm) at the Control Unit
 - f. Noise Figure: 6.0 dB maximum measured receiver threshold
 - g. Automatic Gain Control (AGC): 40.0 dB Gain Variation Compensation
 - h. Mean Time Between Failure (MTBF): 50,000 hours minimum (at least 5 years) based on 24-hour day
 - i. Emission Designator: 16K00F3E
- 2) Voice and Audio Standards:
 - a. Input and Output Signal Level: 0.0 dBm at 1 kilo Hertz (kHz) test tone modulation level. Each level must be variable over a 6.0 dB range
 - b. Input and Output Impedance: 600 Ohms Balanced (Bal)
 - c. Input and Output Signals: Terminated on each Audio Control Unit
 - d. Frequency Range: 50 Hertz (Hz) to 3.0 kHz + 1.0 percent, minimum
 - e. S/N Ratio: 60 decibels per millivolt (dBmV) + 1.0 dBmV
 - f. Cross Modulation: -46 Db
 - g. Hum Modulation: -55 Db
 - h. Isolation (control unit to unit): 24 dB, minimum
- 3) Control Signal Standards:
 - a. Input and Output Signal: 0.0 dBmV + 1.0 dBmV
 - b. Input and Output Signals: Terminated on each Radio Control Unit
 - c. Input and Output Impedance: 600 Ohms, Bal
 - d. Channel Bandwidth: [_____]
 - e. Data: 300 Hz to 3.5 kHz (9.6 kilobits per second rate)
 - f. Voice: 50 Hz to 3.0 kHz, + 5.0 percent, minimum
 - g. S/N Ratio: 60 dBmV + 1.0 dBmV

3.1 SUBMITTALS

3.1.1 Submittals required for government review

A. Submittal requirements are outlined in [Division 01] [PWS SOW] [___]

B. [Product Information must include manufacturer's installation instructions, sizing (including required clearance for access and maintenance), utility requirements, isometric drawings, tagged floorplans showing placement for count accountability and accessories/options/consumables list.]

- C. All submittals require Government approval prior to procurement. Submit all listed items herein, with information sufficient to show full compliance with the criteria. Submit all product selections for review and approval, including but not limited to materials, finishes, colors, options, accessories, and complimentary products. Provide for review all warranties and service contracts and any available extended warranty or service options.**
- D. Samples: Furnish material samples and full range of color selection options for all items that offer material and color selections.
- E. Submit and highlight all applicable options for Government review for all items which optional accessories are provided.
- F. [Joint Interoperability Test Command (JTIC) Approval Documentation.]

3.2 QUALITY ASSURANCE

3.2.1 Materials and Equipment

- A. Materials and equipment must be standard products of a manufacturer regularly engaged in the manufacture of products which are of a similar material, design, and workmanship and are offered for sale on the commercial market through advertisements, manufacturer's catalogs, or sales brochures. The products must have been in commercial or industrial use under similar circumstances and of similar size for 2 years prior to selection for approval/procurement. Products must be supportable for at least three years after government acceptance.

3.2.2 Alternative Service Record

- A. Products having less than a 2-year field service record will be acceptable if a certified record of the manufacturer's factory or laboratory tests demonstrating performance compliance is provided to the Contracting Officer.

3.2.3 Service Support

- A. Equipment items must be supported by service organizations located near the equipment installation, able to service the equipment on a regular basis and respond to emergency calls throughout the warranty period.

3.2.4 Manufacturer's Nameplate

- A. Each item of equipment must have an attached nameplate that is securely affixed in a conspicuous space. A nameplate listing only the name of the distributing agent is not acceptable. The nameplate must contain the following fields in English:

1. Manufacturer's name and address
2. Model and Serial Number
3. Item's utility ranges and/or capacities
4. Voltage, amperage, and applicable Underwriters Laboratory (UL) or Conformité Européenne (CE) rating if electrically powered
5. Date of manufacture

3.2.5 Factory Inspection

- A. Arrange and perform all quality control and quality assurance inspections required by the technical sections of the criteria, unless otherwise specified. Report these inspections in the daily report to the Government inspector.

3.2.6 Product Qualifications

- A. The products specified in the technical sections of this criteria establish standards for each item.

3.2.7 Design Parameters

- A. It is not the intention of this Criteria to limit consideration to products of specific manufacturers. The product standards establish the characteristics for which submitted items of equipment will be reviewed and approved by the Government. Equipment furnished must meet each of the following parameters specified in the technical sections:

1. Size of equipment
2. Function of equipment

3. Standard and listed accessories and options
4. Equipment controls and performance of equipment
5. Construction of equipment
6. Finish

3.3 STANDARDS DEVIATIONS

3.3.1 Reporting and Submission for Approval

- A. Submit for approval a record of deviations from the standards listed in section (3.2.7.A.) established for each specified product, before ordering equipment.

3.4 DELIVERY, STORAGE AND PROTECTION

3.4.1 Packaging and Transporting

- A. Each unit of equipment must be placed in a substantial shipping container or crate for safe transportation to final destination. The shipping container or crate for heavy equipment must be on skid construction to facilitate handling by lift equipment.

3.4.2 Packing List

- A. Clearly and legibly indicate on exterior of each container or crate the shipping address and a brief description of contents. Fasten to outside of container a packing list and complete instructions for uncrating equipment and setting it in place. Protect such information in a weatherproof envelope.

3.4.3 Protection

- A. Properly protect all materials and equipment from injury and damage during storage, installation, and acceptance.

3.5 INSTALLATION, VERIFICATION AND ACCEPTANCE TESTING

3.5.1 Qualifications of Installers and Inspectors

- A. If required by product warranty, use installers that are approved and licensed by the manufacturer. When required to complete installation, all electricians and plumbers used must be bonded and licensed in the project's jurisdiction.
- B. [Company specializing in installing the products specified in this section must have a minimum 5 years of documented experience.]
- C. [Company specializing in installing the products specified in this section must be within 200 miles or 4 hours travel time.]

3.5.2 Installation, Operation, Testing and Certification

- A. Products must be delivered in manufacturer's original packaging with manufacturer's installation instructions. Include clearly marked project reference.
- B. Prior to installation, thoroughly examine the equipment, materials, and components for both visual defects and conformance with criteria.
- C. Install all equipment in compliance with manufacturer's written instructions and installation procedures.
- D. After installation, the equipment must be inspected and tested under operating conditions. If the equipment fails an inspection or test, such defects/failures must be corrected. Upon correction of defects/failures, inspect and retest all affected functions related directly and indirectly to the defect or failure. Corrections, replacement, and retesting must be made at no additional expense to the Government.
- E. Provide all items necessary to make equipment fully functional.
- F. Provide appropriately trained personnel to energize, commission, inspect, electrical safety check, calibrate, certify, and provide all required technical testing for equipment and systems. Contractor must provide documentation, test reports and certification documentation attesting that the equipment is properly installed, functional, safe, calibrated, and ready for its intended use.
- G. An equipment item will be considered defective if it cannot be made to meet all established criteria consistent with the activities listed in section (F).

- H. Provide two sets of special tools, software, and any other item/s for each equipment [item] [item type] if required for maintenance and/or future reconfiguration of the item.
- I. Contractor to supply all start-up supplies for medical equipment for a fully operational installation. Contractor must supply to the Government a listing of all needed supplies for ongoing equipment operation for each item of equipment requiring additional supplies for operation.
- J. Engage a factory-authorized service representative to train Government's staff and maintenance personnel to adjust, operate, and maintain medical equipment.
- K. [Confirm functionality of required interfaces to other systems and networks.]

3.6 WARRANTY

3.6.1 Minimum Requirements

- A. Warranty requirements are outlined in [Division 01] [PWS SOW] [____].
- B. [Provide manufacturer's written warranty for all items listed. Provide warranty for a minimum of (1) year against defects in materials and workmanship. Warranty must provide for material, labor and all associated replacement and/or repair costs required to provide for a fully operational equipment replacement or repair. Submit manufacturers and installers standard service contract beyond the warranty period for Government review. Warranty must be transferrable to the final owner without risk of being voided. All warranty certification and documentation must be provided to the final owner after date of acceptance.]
- C. Provide routine warranty service in accordance with manufacturer's warranty requirements, for a period of [12 months (minimum)] [____] after the open for business date. Perform work during regular working hours. Perform service only by factory trained personnel. Maintain a maintenance log of all service orders performed during the warranty period.

3.7 OPERATIONS AND MAINTENANCE (O & M)

3.7.1 Provide the following to the final owner

- A. Provide O & M data for all FFE-LVS as outlined in [Division 01] [PWS SOW] [____].
- B. Upon completion of equipment installation, furnish [two (2)] copies of operators/service/maintenance manuals for each type of equipment which will require service or maintenance
- C. Each manual must contain operating instructions and information required for performing periodic maintenance on the equipment. Each service manual must include an illustrated parts breakdown which identifies each part of the unit with manufacturer's part number, wiring diagrams, and a list of necessary service parts, tools, and equipment needed to support maintenance requirements.
- D. Accessory Catalogs: Upon completion of the Project, furnish two copies of the manufacturer's catalogs containing optional accessory items available for all equipment relative to the procured equipment/system delivered herein.
- E. Provide instruction video for cleaning and maintenance, when available.
- F. Provide cleaning requirements for all items to prevent void of warranty.
- G. [Provide contact information for Repair Technician or Emergency Repair Company]
- H. Provide contact information to [Logistics, Pharmacy, Laboratory, and Biomedical Equipment Services.]
- I. Train designated staff in the operation and maintenance of the provided equipment/system. Provide two training sessions for equipment/system users and two training sessions for maintenance personnel scheduled to accommodate shift work. [Provide training certificates that can be executed up to eleven months after the system is installed, in order to provide a refresher course for each group of trainees.] Provide DVD copy of the training with the O & M data.

--End of Section--