

SECTION 27 05 11

REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes common requirements to communications installations and applies to all sections of Division 27 and Division 28.
- B. Provide completely functioning communications systems.
- C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

1.2 REFERENCES

- A. Abbreviations and Acronyms
 1. Refer to [http: www.cfm.va.gov/til/sdetail.asp](http://www.cfm.va.gov/til/sdetail.asp) for Division 00, ARCHITECTURAL ABBREVIATIONS.
 2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic
CBC	Coupled Bonding Conductor
CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment
CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) – Federal/GSA for VA

dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)
EPBX	Electronic Digital Private Branch Exchange
ESR	Vendor's Engineering Service Report
FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations
FMS	VA's Headquarters or Medical Center Facility's Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile
HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets(refer to HEIC, PA)
HEIC	Head End Interface Cabinets(refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management
ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific, Medical
IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode
LMR	Land Mobile Radio

LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megahertz (10 ⁶ Hz)
mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA's Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health
OSHA	United States Department of Labor Occupational Safety and Health Administration
OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer
PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
RE	Resident Engineer or Senior Resident Engineer
RF	Radio Frequency (refer to FR)
RFI	Radio Frequency Interference (refer to EMI)
RFID	RF Identification (Equipment, System or Personnel)
RMC	Rigid Metal Conduit
RMU	Rack Mounting Unit
RPEC	Radio Paging Equipment Cabinets (refer to HEC, HEIC, PA)
RTLS	Real Time Location Service or System
RUS	Rural Utilities Service
SCC	Security Control Console (refer to PCR, SPCC)
SMCS	Spectrum Management and Communications Security (COMSEC)

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SFO	Solicitation for Offers
SME	Subject Matter Experts (refer to AHJ)
SMR	Specialized Mobile Radio
SMS	Security Management System
SNMP	Simple Network Management Protocol
SPCC	Security Police Control Center (refer to PCR, SMS)
STP	Shielded Balanced Twisted Pair (refer to UTP)
STR	Stacked Telecommunications Room
TAC	VA's Technology Acquisition Center, Austin, Texas
TCO	Telecommunications Outlet
TER	Telephone Equipment Room
TGB	Telecommunications Grounding Busbar (also Secondary Bonding Busbar (SBB))
TIP	Telecommunications Infrastructure Plant
TMGB	Telecommunications Main Grounding Busbar (also Primary Bonding Busbar (PBB))
TMS	Traffic Management System
TOR	Telephone Operators Room
TP	Balanced Twisted Pair (refer to STP and UTP)
TR	Telecommunications Room (refer to STR)
TWP	Twisted Pair
UHF	Ultra High Frequency (Radio)
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service (refer to PCS)
UPS	Uninterruptible Power Supply
USC	United States Code
UTP	Unshielded Balanced Twisted Pair (refer to TP and STP)
UV	Ultraviolet
V	Volts
VAAR	Veterans Affairs Acquisition Regulation
VACO	Veterans Affairs Central Office
VAMC	VA Medical Center (refer to CBOC, OPC, VACO)
VCCS	TIP's Vertical Cross Connection System (refer to CCS and HCCS)
VHF	Very High Frequency (Radio)
VISN	Veterans Integrated Services Network (refers to geographical region)
VSWR	Voltage Standing Wave Ratio
W	Watts
WEB	World Electronic Broadcast
WiMAX	Worldwide Interoperability (for MW Access)
WI-FI	Wireless Fidelity
WMTS	Wireless Medical Telemetry Service
WSP	Wireless Service Providers

B. Definitions:

1. Access Floor: Pathway system of removable floor panels supported on adjustable pedestals to allow cable placement in area below.
2. BNC Connector (BNC): United States Military Standard MIL-C-39012/21 bayonet-type coaxial connector with quick twist mating/unmating, and two lugs preventing accidental disconnection from pulling forces on cable.
3. Bond: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct any currents likely to be imposed to earth ground.
4. Bundled Microducts: All forms of jacketed microducts.
5. Conduit: Includes all raceway types specified.

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6. Conveniently Accessible: Capable of being reached without use of ladders, or without climbing or crawling under or over obstacles such as, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
7. DEMARC, Extended DMARC or ENTR: Service provider's main point of demarcation owned by LEC or service provider and establishes a physical point where service provider's responsibilities for service and maintenance end. This point is called NID, in data networks.
8. Effectively Grounded: Intentionally bonded to earth through connections of low impedance having current carrying capacity to prevent buildup of currents and voltages resulting in hazard to equipment or persons.
9. Electrical Supervision: Analyzing a system's function and components (i.e. cable breaks / shorts, inoperative stations, lights, LEDs and states of change, from primary to backup) on a 24/7/365 basis; provide aural and visual emergency notification signals to minimum two remote designated or accepted monitoring stations.
10. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
11. Emergency Call Systems: Wall units (in parking garages and stairwells) and pedestal mounts (in parking lots) typically provided with a strobe, camera and two-way audio communication functions.
12. Project 25 (2014) (P25 (TIA-102 Series)): Set of standards for local, state and Federal public safety organizations and agencies digital LMR services. P25 is applicable to LMR equipment authorized or licensed under the US Department of Commerce National Telecommunications and Information Administration or FCC rules and regulations, and is a required standard capability for all LMR equipment and systems.
13. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
14. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
15. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
16. Head End (HE): Equipment, hardware and software, or a master facility at originating point in a communications system designed for centralized communications control, signal processing, and distribution that acts as a common point of connection between equipment and devices connected to a network of interconnected equipment, possessing greatest authority for allowing information to be exchanged, with whom other equipment is subordinate.
17. Microducts: All forms of air blown fiber pathways.
18. Ohm: A unit of resistive measurement.
19. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
20. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider, but designated by Government as point within facility considered the DEMARC.
21. Sound (SND): Changing air pressure to audible signals over given time span.
22. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
23. Telecommunications Bonding Backbone (TBB): Conductors of appropriate size (minimum 53.49 mm², 1/0 AWG) stranded copper wire, that connect to Grounding Electrode System and route to telecommunications main grounding busbar (TMGB) and circulate to interconnect various TGBs and other locations shown on drawings.
24. Voice over Internet Protocol (VoIP): A telephone system in which voice signals are converted to packets and transmitted over LAN network using Transmission Control Protocol (TCP)/Internet Protocol (IP). VA'S VoIP is not listed or coded for life and public safety, critical, emergency or other protection functions. When VoIP system or equipment is provided instead of PBX system or equipment, each TR (STR) and

DEMARC requires increased AC power provided to compensate for loss of PBX's telephone instrument line power; and, to compensate for absence of PBX's UPS capability.

- 25. Wide Area Network (WAN): A digital network that transcends localized LANs within a given geographic location. VA'S WAN/LAN is not nationally listed or coded for life and public safety, critical, emergency or other safety functions.

1.3 APPLICABLE PUBLICATIONS

- A. Applicability of Standards: Unless documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into the documents to extent referenced. Such standards are made a part of these documents by reference.
 - 1. Each entity engaged in construction must be familiar with industry standards applicable to its construction activity.
 - 2. Obtain standards directly from publication source, where copies of standards are needed to perform a required construction activity.

- B. Government Codes, Standards and Executive Orders: Refer to <http://www.cfm.va.gov/TIL/cPro.asp>:
 - 1. Federal Communications Commission, (FCC) CFR, Title 47:
 - Part 15.....Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations
 - Part 47.....Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment
 - Part 58.....Television Broadcast Service
 - Part 73.....Radio and Television Broadcast Rules
 - Part 90.....Rules and Regulations, Appendix C
 - Form 854.....Antenna Structure Registration
 - Chapter XXIIINational Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book' – Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations
 - 2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:RUS 1755Telecommunications Standards and Specifications for Materials, Equipment and Construction:
 - RUS Bull 1751F-630Design of Aerial Cable Plants
 - RUS Bull 1751F-640Design of Buried Cable Plant, Physical Considerations
 - RUS Bull 1751F-643Underground Plant Design
 - RUS Bull 1751F-815Electrical Protection of Outside Plants,
 - RUS Bull 1753F-201Acceptance Tests of Telecommunications Plants (PC-4)
 - RUS Bull 1753F-401Splicing Copper and Fiber Optic Cables (PC-2)
 - RUS Bull 345-50Trunk Carrier Systems (PE-60)
 - RUS Bull 345-65Shield Bonding Connectors (PE-65)
 - RUS Bull 345-72Filled Splice Closures (PE-74)
 - RUS Bull 345-83Gas Tube Surge Arrestors (PE-80)
 - 3. US Department of Commerce/National Institute of Standards Technology,(NIST): Requirements for Communications Installations

- FIPS PUB 1-1 Telecommunications Information Exchange
 - FIPS PUB 100/1 Interface between Data Terminal Equipment (DTE) Circuit Terminating Equipment for operation with Packet Switched Networks, or Between Two DTEs, by Dedicated Circuit
 - FIPS PUB 140/2 Telecommunications Information Security Algorithms
 - FIPS PUB 143 General Purpose 37 Position Interface between DTE and Data Circuit Terminating Equipment
 - FIPS 160/2 Electronic Data Interchange (EDI),
 - FIPS 175 Federal Building Standard for Telecommunications Pathway and Spaces
 - FIPS 191 Guideline for the Analysis of Local Area Network Security
 - FIPS 197 Advanced Encryption Standard (AES)
 - FIPS 199 Standards for Security Categorization of Federal Information and Information Systems
4. US Department of Defense, (DoD):
- MIL-STD-188-110 Interoperability and Performance Standards for Data Modems
 - MIL-STD-188-114 Electrical Characteristics of Digital Interface Circuits
 - MIL-STD-188-115 Communications Timing and Synchronizations Subsystems
 - MIL-C-28883 Advanced Narrowband Digital Voice Terminals
 - MIL-C-39012/21 Connectors, Receptacle, Electrical, Coaxial, Radio Frequency, (Series BNC (Uncabled), Socket Contact, Jam Nut Mounted, Class 2)
5. US Department of Health and Human Services:
 The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy, Security and Breach Notification Rules
6. US Department of Justice:
 2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).
7. US Department of Labor, (DoL) - Public Law 426-62 – CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards):
- Subpart 7 Approved NRTLs; obtain a copy at <https://www.osha.gov/dts/otpca/nrtl/nrtllist.html>
 - Subpart 35 Compliance with NFPA 101, Life Safety Code
 - Subpart 36 Design and Construction Requirements for Exit Routes
 - Subpart 268 Telecommunications
 - Subpart 305 Wiring Methods, Components, and Equipment for General Use
 - Subpart 508 Americans with Disabilities Act Accessibility Guidelines; technical requirement for accessibility to buildings and facilities by individuals with disabilities
8. US Department of Transportation, (DoT):
- a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C – Federal Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E – Advisory Circulars Standards for Construction of Antenna Towers, and 7450 and 7460-2 – Antenna Construction Registration Forms.
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- 9. US Department of Veterans Affairs (VA): Office of Telecommunications (OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum Management and COMSEC Service (SMCS), AHJ for:
 - a. CoG, "Continuance of Government" communications guidelines and compliance.
 - b. COMSEC, "VA wide coordination and control of security classified communication assets."
 - c. COOP, "Continuance of Operations" emergency communications guidelines and compliance.
 - d. FAA, FCC, and US Department of Commerce National Telecommunications and Information Administration, "VA wide RF Co-ordination, Compliance and Licensing."
 - e. Handbook 6100 – Telecommunications: Cyber and Information Security Office of Cyber and Information Security, and Handbook 6500 – Information Security Program.
 - f. Low Voltage Special Communications Systems "Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance and Life Safety Certifications for CFM and VA Facility Low Voltage Special Communications Projects (except Fire Alarm, Telephone and Data Systems)."
 - g. SATCOM, "Satellite Communications" guidelines and compliance, and Security and Law Enforcement Systems – "Coordinates the Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance, DEA and Public Safety Certification(s) for CFM and VA Facility Security Low Voltage Special Communications and Physical Security Projects.
 - h. VHA's National Center for Patient Safety – Veterans Health Administration (VHA) Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
 - i. VA's CEOSH, concurrence with warning identified in VA Directive 7700.
 - j. Wireless and Handheld Devices, "Guidelines and Compliance,"
 - k. Office of Security and Law Enforcement: VA Directive 0730 and Health Special Presidential Directive (HSPD)-12.

- C. NRTL Standards: Refer to <https://www.osha.gov/laws-regs/regulations/standardnumber/1926>
 - 1. Canadian Standards Association (CSA); same tests as presented by UL
 - 2. Communications Certifications Laboratory (CEL); same tests as presented by UL.
 - 3. Intertek Testing Services NA, Inc., (ITSNA), formerly Edison Testing Laboratory (ETL) same tests as presented by UL).
 - 4. Underwriters Laboratory (UL):
 - 1-2005 Flexible Metal Conduit
 - 5-2011 Surface Metal Raceway and Fittings
 - 6-2007 Rigid Metal Conduit
 - 44-010 Thermoset-Insulated Wires and Cables
 - 50-1995 Enclosures for Electrical Equipment
 - 65-2010 Wired Cabinets
 - 83-2008 Thermoplastic-Insulated Wires and Cables
 - 96-2005 Lightning Protection Components
 - 96A-2007 Installation Requirements for Lightning Protection Systems
 - 360-2013 Liquid-Tight Flexible Steel Conduit

444-2008 Communications Cables
467-2013 Grounding and Bonding Equipment
486A-486B-2013 Wire Connectors
486C-2013..... Splicing Wire Connectors
486D-2005..... Sealed Wire Connector Systems
486E-2009..... Standard for Equipment Wiring Terminals for Use with Aluminum
and/or Copper Conductors
493-2007 Thermoplastic-Insulated Underground Feeder and Branch Circuit
Cable

497/497A/497B/497C
497D/497E Protectors for Paired Conductors/Communications Circuits/Data
Communications and Fire Alarm Circuits/coaxial circuits/voltage
protections/Antenna Lead In

510-2005 Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
514A-2013..... Metallic Outlet Boxes
514B-2012..... Fittings for Cable and Conduit
514C-1996..... Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-2011 Schedule 40 and 80 Rigid PVC Conduit
651A-2011 Type EB and A Rigid PVC Conduit and HDPE Conduit
797-2007 Electrical Metallic Tubing
884-2011 Underfloor Raceways and Fittings
1069-2007 Hospital Signaling and Nurse Call Equipment
1242-2006 Intermediate Metal Conduit
1449-2006 Standard for Transient Voltage Surge Suppressors
1479-2003 Fire Tests of Through-Penetration Fire Stops
1480-2003 Speaker Standards for Fire Alarm, Emergency, Commercial and
Professional use

1666-2007 Standard for Wire/Cable Vertical (Riser) Tray Flame Tests
1685-2007 Vertical Tray Fire Protection and Smoke Release Test for
Electrical and Fiber Optic Cables
1861-2012 Communication Circuit Accessories
1863-2013 Standard for Safety, communications Circuits Accessories
1865-2007 Standard for Safety for Vertical-Tray Fire Protection and Smoke-
Release Test for Electrical and Optical-Fiber Cables
2024-2011 Standard for Optical Fiber Raceways
2024-2014 Standard for Cable Routing Assemblies and Communications
Raceways
2196-2001 Standard for Test of Fire Resistive Cable
60950-1 ed. 2-2014..... Information Technology Equipment Safety

- D. Industry Standards:
1. Advanced Television Systems Committee (ATSC):
 - A/53 Part 1: 2013ATSC Digital Television Standard, Part 1, Digital Television System
 - A/53 Part 2: 2011ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics
 - A/53 Part 3: 2013ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics
 - A/53 Part 4: 2009ATSC Digital Television Standard, Part 4, MPEG-2 Video System Characteristics
 - A/53 Part 5: 2014ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics
 - A/53 Part 6: 2014ATSC digital Television Standard, Part 6, Enhanced AC-3 Audio System Characteristics
 2. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.
 3. American Society of Mechanical Engineers (ASME):
 - A17.1 (2013)..... Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices
 - 17.3 (2011) Safety Code for Existing Elevators and Escalators
 - 17.4 (2009) Guide for Emergency Personnel
 - 17.5 (2011) Elevator and Escalator Electrical Equipment
 4. American Society for Testing and Materials (ASTM):
 - B1 (2001)..... Standard Specification for Hard-Drawn Copper Wire
 - B8 (2004)..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 - D1557 (2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft³ (2,700 kN-m/m³)
 - D2301 (2004) Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape
 - B258-02 (2008) Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors
 - D709-01(2007) Standard Specification for Laminated Thermosetting Materials
 - D4566 (2008) Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
 5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at <https://ebiznet.sbc.com/sbcnebs/>
 - ATT-TP-76200 (2013) Network Equipment and Power Grounding, Environmental, and Physical Design Requirements
 - ATT-TP-76300(2012) Merged AT&T Affiliate Companies Installation Requirements
 - ATT-TP-76305 (2013) Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways

- ATT-TP-76306 (2009) Electrostatic Discharge Control
- ATT-TP-76400 (2012) Detail Engineering Requirements
- ATT-TP-76402 (2013) AT&T Raised Access Floor Engineering and Installation Requirements
- ATT-TP-76405 (2011) Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments
- ATT-TP-76416 (2011) Grounding and Bonding Requirements for Network Facilities
- ATT-TP-76440 (2005) Ethernet Specification
- ATT-TP-76450 (2013) Common Systems Equipment Interconnection Standards for AT&T Network Equipment Spaces
- ATT-TP-76461 (2008) Fiber Optic Cleaning
- ATT-TP-76900 (2010) AT&T Installation Testing Requirement
- ATT-TP-76911 (1999) AT&T LEC Technical Publication Notice
- 6. British Standards Institution (BSI):
 - BS EN 50109-2 Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications – All Parts & Sections. October 1997
- 7. Building Industry Consulting Service International(BICSI):
 - ANSI/BICSI 002-2011 Data Center Design and Implementation Best Practices
 - ANSI/BICSI 004-2012 Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
 - ANSI/NECA/BICSI
 - 568-2006 Standard for Installing Commercial Building Telecommunications Cabling
 - NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
 - ANSI/BICSI 005-2013 Electronic Safety and Security (ESS) System Design and Implementation Best Practices
- 8. Electronic Components Assemblies and Materials Association,(ECA).
 - ECA EIA/RS-270 (1973)Tools, Crimping, Solderless Wiring Devices – Recommended Procedures for User Certification
 - EIA/ECA 310-E (2005) Cabinets, and Associated Equipment
- 9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.
- 10. Insulated Cable Engineers Association (ICEA):
 - ANSI/ICEA
 - S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems
 - ANSI/ICEA
 - S-84-608-2010 Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640(2011) Optical Fiber Outside Plant Communications Cable
 - ANSI/ICEA

S-90-661-2012 Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems

S-98-688 (2012) Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors

S-99-689 (2012) Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors

ICEA S-102-700
 (2004) Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements

11. Institute of Electrical and Electronics Engineers (IEEE):
 ISSN 0739-5175 March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks

IEEE C2-2012 National Electrical Safety Code (NEC)

C62.41.2-2002/
 Cor 1-2012 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4)

C62.45-2002..... IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

81-2012 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System

100-1992 IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms

602-2007 IEEE Recommended Practice for Electric Systems in Health Care Facilities

1100-2005 IEEE Recommended Practice for Powering and Grounding Electronic Equipment

12. International Code Council:
 AC193 (2014) Mechanical Anchors in Concrete Elements

13. International Organization for Standardization (ISO):
 ISO/TR 21730 (2007) Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices

14. National Electrical Manufacturers Association (NEMA):
 NEMA 250 (2008) Enclosures for Electrical Equipment (1,000V Maximum)

ANSI C62.61 (1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

ANSI/NEMA FB 1 (2012) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing (EMT) and Cable

ANSI/NEMA OS 1 (2009) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

NEMA SB 19 (R2007) NEMA Installation Guide for Nurse Call Systems

- TC 3 (2004) Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
- NEMA VE 2 (2006)..... Cable Tray Installation Guidelines
15. National Fire Protection Association (NFPA):
- 70E-2015..... Standard for Electrical Safety in the Workplace
 - 70-2020 National Electrical Code (NEC)
 - 72-2013 National Fire Alarm Code
 - 75-2013 Standard for the Fire Protection of Information Technological Equipment
 - 76-2012 Recommended Practice for the Fire Protection of Telecommunications Facilities
 - 77-2014 Recommended Practice on Static Electricity
 - 90A-2015..... Standard for the Installation of Air Conditioning and Ventilating Systems
 - 99-2018 Health Care Facilities Code
 - 101-2018 Life Safety Code
 - 241 Safeguarding construction, alternation and Demolition Operations
 - 255-2006 Standard Method of Test of Surface Burning Characteristics of Building Materials
 - 262 - 2011 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
 - 780-2014 Standard for the Installation of Lightning Protection Systems
 - 1221-2013 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
 - 5000-2015 Building Construction and Safety Code
16. Society for Protective Coatings (SSPC):
- SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning
17. Society of Cable Telecommunications Engineers (SCTE):
- ANSI/SCTE 15 2006 Specification for Trunk, Feeder and Distribution Coaxial Cable
18. Telecommunications Industry Association (TIA):
- TIA-120 Series Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)
 - TIA TSB-140..... Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)
 - TIA-155..... Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T (2010)
 - TIA TSB-162-A..... Telecommunications Cabling Guidelines for Wireless Access Points (2013)
 - TIA-222-G..... Structural Standard for Antenna Supporting Structures and Antennas (2014)

TIA/EIA-423-B	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)
TIA-455-C.....	General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)
TIA-455-53-A.....	FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)
TIA-455-61-A.....	FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)
TIA-472D000-B	Fiber Optic Communications Cable for Outside Plant Use (July 2007)
ANSI/TIA-492-B	62.5- μ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)
ANSI/TIA-492AAAB-A	50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009)
TIA-492CAAA.....	Detail Specification for Class IVa Dispersion- Unshifted Single-Mode Optical Fibers (September 2002)
TIA-492E000	Sectional Specification for Class IVd Nonzero- Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)
TIA-526-7-B.....	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (December 2008)
TIA-526.14-A.....	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14 (August 1998)
TIA-568.....	Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas
TIA-569.....	Revision/Edition C Telecommunications Pathways and Spaces (March 2013)
TIA-574.....	Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)
TIA/EIA-590-A	Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)
TIA-598-D.....	Optical Fiber Cable Color Coding (January 2005)
TIA-604-10-B.....	Fiber Optic Connector Intermateability Standard (August 2008)

ANSI/TIA-606-B.....	Administration Standard for Telecommunications Infrastructure (2012)
TIA-607-B.....	Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)
TIA-613.....	High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)
ANSI/TIA-758-B.....	Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)
ANSI/TIA-854	A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)
ANSI/TIA-862-A.....	Building Automation Systems Cabling Standard (April 2011)
TIA-942-A	Telecommunications Infrastructure Standard for Data Centers (March 2014)
TIA-1152.....	Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)
TIA-1179.....	Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

1.4 SINGULAR NUMBER

- A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

1.5 RELATED WORK

- A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.
1. Field Cutting and Patching: Section 09 91 00, PAINTING.
 2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
 3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
 4. Control of environmental pollution and damage for air, water, and land resources: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
 5. Requirements for non-hazardous building construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
 6. General requirements and procedures to comply with various federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable design: Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS.
 7. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction: Section 07 84 00, FIRESTOPPING.
 8. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
 9. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
 10. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
 11. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

12. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
13. Wiring devices: Section 26 27 26, WIRING DEVICES.
14. Underground ducts, raceways, precast manholes and pull boxes: Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.
15. General requirements common to more than one section in Division 28: Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
16. Conductors and cables for electronic safety and security systems: Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY.
17. Low impedance path to ground for electronic safety and security system ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR SECURITY SYSTEMS.
18. Conduits and partitioned telecommunications raceways for Electronic Safety and Security systems: Section 28 05 28.33, CONDUITS AND BACK BOXES FOR ELECTRONIC SAFETY AND SECURITY.
19. Physical Access Control System field-installed controllers connected by data transmission network: Section 28 13 00, PHYSICAL ACCESS DETECTION.
20. Detection and screening systems: Section 28 13 53, SECURITY ACCESS DETECTION.
21. Intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions: Section 28 16 00, INTRUSION DETECTION EQUIPMENT AND SYSTEMS.
22. Video surveillance system cameras, data transmission wiring, and control stations with associated equipment: Section 28 23 00, VIDEO SURVEILLANCE EQUIPMENT AND SYSTEMS.
23. Alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring: Section 28 31 00, FIRE DETECTION AND ALARM.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.
- B. Be proactive in scheduling work.
 1. Use of premises is restricted at times directed by COR.
 2. Movement of materials: Unload materials and equipment delivered to site.
 3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work.
 5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
 6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.
- C. Contact the Office of Telecommunications, Special Communications Team (005OP2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.
- D. Communications Project Manager Responsibilities:
 1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
 2. Coordinate with related work indicated on drawings or specified.
 3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

1.7 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide parts list including quantity of spare parts.
- C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.
- D. Provide Source Quality Control Submittal:
 - 1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of warranty maintenance are authorized representatives of OEM. Include individual's legal name, contact information and OEM credentials in certification.
 - 2. Submit written certification from OEM that wiring and connection diagrams meet Government Life Safety Guidelines, NFPA, NEC, NRTL, these specifications, and Joint Commission requirements and instructions, requirements, recommendations, and guidance set forth by OEM for the proper performance of system.
 - 3. Pre-acceptance Certification: Certification in accordance with procedure outlined in Section 01 00 00, GENERAL REQUIREMENTS and specific Division 27 qualification documentation.
- E. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:
 - 1. Installation location and name.
 - 2. Owner's name and contact information including, address, telephone and email.
 - 3. Date of project start and date of final acceptance.
 - 4. System project number.
 - 5. Three paragraph description of each system related to this project; include function, operation, and installation.
- F. Provide delegated design submittals (e.g. seismic support design).
- G. Submittals are required for all equipment anchors and supports. Include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or conduit. Anchors and supports to resist seismic load based on seismic design categories per section 4.0 of VA seismic design requirements H-18-8 dated August, 2013.
- H. Test Equipment List:
 - 1. Supply test equipment of accuracy better than parameters to be tested.
 - 2. Submit test equipment list including make and model number:
 - 3. ANSI/TIA-1152 Level IIIe IV twisted pair cabling test instrument.
 - 4. Fiber optic insertion loss power meter with light source.
 - 5. Optical time domain reflectometer (OTDR).
 - 6. Volt-Ohm meter.
 - 7. Digital camera.
 - 8. Signal level meter.
 - 9. Color video monitor with audio capability.
 - 10. 100 MHz oscilloscope with video adapters.
 - 11. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
 - 12. Provide sample test and evaluation reports.
- I. Submittal Drawings:
 - 1. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of

telecommunication spaces showing racks, termination blocks, and cable paths. Include following rooms:

2. Telecommunications rooms.
 3. Building Entrance Facility/Demarcation rooms.
 4. Server rooms/Data Center.
 5. Equipment rooms.
 6. Antenna Head End rooms.
 7. Logical Drawings: Provide logical riser or schematic drawings for all systems.
 8. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.
 9. Access Panel Schedule on Submittal Drawings: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment.
- J. Provide sustainable design submittals.
- K. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

1.8 CLOSEOUT SUBMITTALS

- A. Provide following closeout submittals prior to project closeout date:
1. Warranty certificate.
 2. Evidence of compliance with requirements such as low voltage certificate of inspection.
 3. Project record documents.
 4. Instruction manuals and software that are a part of system.
- B. Maintenance and Operation Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
1. Prepare a manual for each system and equipment specified.
 2. Furnish on portable storage drive in PDF format or equivalent accepted by COR.
 3. Furnish complete manual as specified in specification section, fifteen days prior to performance of systems or equipment test.
 4. Furnish remaining manuals prior to final completion.
 5. Identify storage drive "MAINTENANCE AND OPERATION MANUAL" and system name.
 6. Include name, contact information and emergency service numbers of each subcontractor installing system or equipment and local representatives for system or equipment.
 7. Provide a Table of Contents and assemble files to conform to Table of Contents.
 8. Operation and Maintenance Data includes:
 9. Approved shop drawing for each item of equipment.
 10. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
 11. A control sequence describing start-up, operation, and shutdown.
 12. Description of function of each principal item of equipment.
 13. Installation and maintenance instructions.
 14. Safety precautions.
 15. Diagrams and illustrations.
 16. Test Results and testing methods.
 17. Performance data.
 18. Pictorial "exploded" parts list with part numbers. Emphasis to be placed on use of special tools and instruments. Indicate sources of supply, recommended spare parts, and name of servicing organization.
 19. Warranty documentation indicating end date and equipment protected under warranty.
 20. Appendix; list qualified permanent servicing organizations for support of equipment, including addresses and certified personnel qualifications.
- C. Record Wiring Diagrams:

1. Red Line Drawings: Keep one E size 91.44 cm x 121.92 cm (36 inches x 48 inches) set of floor plans, on site during work hours, showing installation progress marked and backbone cable labels noted. Make these drawings available for examination during construction meetings or field inspections.
 2. General Drawing Specifications: Detail and elevation drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size 61 cm x 91.44 cm (24" x 36") with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). Building composite floor plan drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 3.175 mm = 30.48 cm (1/8 inch = 1' 0 inch).
 3. Building Composite Floor Plans: Provide building floor plans showing work area outlet locations and configuration, types of jacks, distance for each cable, and cable routing locations.
 4. Floor plans to include:
 5. Final room numbers and actual backbone cabling and pathway locations and labeling.
 6. Inputs and outputs of equipment identified according to labels installed on cables and equipment
 7. Device locations with labels.
 8. Conduit.
 9. Head-end equipment.
 10. Wiring diagram.
 11. Labeling and administration documentation.
 12. Submit Record Wiring Diagrams within five business days after final cable testing.
 13. Deliver Record Wiring Diagrams as CAD files in .dwg formats as determined by COR.
 14. Deliver four complete sets of electronic record wiring diagrams to COR on portable storage drive.
- D. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within four hours of receipt of notification service is needed.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. After approval and prior to installation, furnish COR with the following:
1. A 300 mm (12 inch) length of each type and size of wire and cable along with tag from coils of reels from which samples were taken.
 2. One coupling, bushing and termination fitting for each type of conduit.
 3. Samples of each hanger, clamp and supports for conduit and pathways.
 4. Duct sealing compound.

1.10 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer must produce, as a principal product, the equipment and material specified for this project, and have manufactured item for at least three years.
- B. Product and System Qualification:
1. OEM must have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
 2. Government reserves the right to require a list of installations where products have been in operation before approval.
 3. Authorized representative of OEM must be responsible for design, satisfactory operation of installed system, and certification.
- C. Trade Contractor Qualifications: Trade contractor must have completed three or more installations of similar systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identify these installations as a part of submittal.

- D. System Supplier Qualifications: System supplier must be authorized by OEM to warranty installed equipment.
- E. Telecommunications technicians assigned to system must be trained, and certified by OEM on installation and testing of system; provide written evidence of current OEM certifications for installers.
- F. Manufactured Products:
 - 1. Comply with FAR clause 52.236-5 for material and workmanship.
 - 2. When more than one unit of same class of equipment is required, units must be product of a single manufacturer.
 - 3. Equipment Assemblies and Components:
 - 4. Components of an assembled unit need not be products of same manufacturer.
 - 5. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
 - 6. Provide compatible components for assembly and intended service.
 - 7. Constituent parts which are similar must be product of a single manufacturer.
 - 8. Identify factory wiring on equipment being furnished and on wiring diagrams.
- G. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days prior to manufacturer performing the factory tests.
 - 1. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Government's approval of submittals must be obtained for equipment and material before delivery to job site.
 - 2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory cable, patch panels, and related equipment.
- B. Storage and Handling Requirements:
 - 1. Equipment and materials must be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
 - 2. Store and protect equipment in a manner that precludes damage or loss, including theft.
 - 3. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.
 - 4. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.
- C. Coordinate storage.

1.12 FIELD CONDITIONS

- A. Where variations from documents are requested in accordance with GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components must include additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
- B. A contract adjustment or additional time will not be granted because of field conditions pursuant to FAR 52.236-2 and FAR 52.236-3; a contract adjustment or additional time will not be granted for additional work required for complete and usable construction and systems pursuant to FAR 52.246-12.

1.13 WARRANTY

- A. Comply with FAR clause 52.246-21, except as follows:

1. Warranty material and equipment to be free from defects, workmanship, and remain so for a period of one year for Emergency Systems from date of final acceptance of system by Government; provide OEM's equipment warranty document to COR.
2. Government maintenance personnel must have ability to contact OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time; contractor and OEM must provide this capability.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Provide communications spaces and pathways conforming to TIA 569, at a minimum.

2.2 EQUIPMENT IDENTIFICATION

- A. Provide laminated black phenolic resin with a white core nameplates with minimum 6 mm (1/4 inch) high engraved lettering.
- B. Nameplates furnished by manufacturer as standard catalog items, unless other method of identification is indicated.

2.3 UNDERGROUND WARNING TAPE

- A. Underground Warning: Standard 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type; red with black letters imprinted with "CAUTION BURIED ELECTRIC LINE BELOW", orange with black letters imprinted with "CAUTION BURIED TELEPHONE LINE BELOW" or orange with black letters imprinted with "CAUTION BURIED FIBER OPTIC LINE BELOW", as applicable.

2.4 WIRE LUBRICATING COMPOUND

- A. Provide non-hardening or forming adhesive coating cable lubricants suitable for cable jacket material and raceway.

2.5 FIREPROOFING TAPE

- A. Provide flexible, conformable fabric tape of organic composition and coated one side with flame-retardant elastomer.
- B. Tape must be self-extinguishing and cannot support combustion; arc-proof and fireproof.
- C. Tape cannot deteriorate when subjected to water, gases, salt water, sewage, or fungus; and tape must be resistant to sunlight and ultraviolet light.
- D. Application must withstand a 200-ampere arc for minimum 30 seconds.
- E. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

2.6 UNDERGROUND CABLES

- A. Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound.
- B. Provide closure of adequate strength to protect splice and maintain cable shield electrical continuity in buried environment.
- C. Provide re-enterable encapsulating compound maintaining chemical stability of closure.
- D. Provide filled splice cases in accordance with RUS Bull 345-72.
- E. Provide gel filled cable meeting requirements of ICEA S-99-689 and RUS 1755.390.
- F. In Vault or Manhole:

1. Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound
2. Closure must be suitable thermoplastic, thermo-set, or stainless steel material supplying structural strength to pass mechanical and electrical requirements in a vault or maintenance hole (manhole) environment.

- G. Re-Enterable Encapsulating Compound: Product maintaining chemical stability of closure.
- H. Provide gel-filled splice cases in accordance with RUS Bull 345-72.

2.7 AERIAL (ABOVEGROUND) ENCLOSURES

- A. Provide aboveground enclosures constructed of ultraviolet resistant PVC pole mounting in accordance with RUS 1755.
- B. Size enclosures and install marker.
- C. Secure covers to prevent unauthorized entry.
- D. Provide gel filled cable meeting requirements of ICEA S-99-689, and RUS 1755.390; except, Figure 8 distribution wire suitable for aerial installation with:
1. 26,700 N (6,000 pound); or
 2. 6,000 pound Class A galvanized steel; or
 3. 26,700 N (6,000 pound) aluminum-clad steel strand.

2.8 TEMPORARY TIP PATHS (OVERHEAD TRACKS, ROAD/PATH BRIDGES, ETC.)

- A. Provide for copper, fiber optic, RF, coaxial and designated electronic system cables to maintain facility communications service during construction and install so as to not present a pedestrian and traffic (including construction) safety hazard.
- B. TIP temporary cable installations are not required to meet industry standards; but each must be reviewed and accepted, in writing, by COR with concurrences from SMCS 005OP2H3, OI&T and facility safety officer, prior to installation.
1. Be responsible for work associated with each temporary TIP path installation, required by system design and its removal when determined no longer necessary.
 2. Survey outside TIP locations usually encountered, including roads, driveways, marked paths, high traffic passage ways or personnel walkways, and provide COR with a plan for temporary paths.

2.9 ACCESS PANELS

- A. Panels: 304 mm x 304 mm (12 inches by 12 inches), or size allowed by location to provide optimum access to equipment for maintenance and service.
- B. Provide access panels and doors as required to allow service of materials and equipment that require inspection, replacement, repair or service.
- C. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling; ceilings consisting of lay-in or removable splined tiles do not require access panels.
- D. Provide access panels with same fire rating classification as surface penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Penetrations and Sleeves:
1. Lay out penetration and sleeve openings in advance, to permit provision in work.
 2. Set sleeves in forms before concrete is poured.
 3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc.

4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.
5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
6. Fill slots, sleeves and other openings in floors or walls if not used.
7. Fill spaces in openings after installation of conduit or cable.
8. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
9. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
10. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
11. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
12. Annular space between conduit and sleeve must be minimum 6 mm (1/4 inch).
13. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.
14. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
15. Do not support piping risers or conduit on sleeves.
16. Identify unused sleeves and slots for future installation.
17. Provide core drilling if walls are poured or otherwise constructed without sleeves and wall penetration is required; do not penetrate structural members.

B. Core Drilling:

1. Avoid core drilling whenever possible.
2. Coordinate openings with other trades and utilities, and prevent damage to structural reinforcement.
3. Investigate existing conditions in vicinity of required opening prior to coring, including an x-ray of floor if determined necessary by competent person or COR.
4. Protect areas from damage.

C. Verification of In-Place Conditions:

1. Verify location, use and status of all material, equipment, and utilities that are specified, indicated, or determined necessary for removal.
2. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
3. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
4. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under following conditions and then only after arranging to provide temporary utility services, according to requirements indicated:
5. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
6. Do not proceed with utility interruptions without Government's written permission.

D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall and ceiling mounting of equipment as required.

E. Provide steel supports and hardware for installation of hangers, anchors, guides, and other support hardware.

F. Obtain and analyze catalog data, weights, and other pertinent data required for coordination of equipment support provisions and installation.

G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

3.2 INSTALLATION - GENERAL

A. Coordinate systems, equipment, and materials installation with other building components.

- B. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.
- C. Conform to VAAR 852.236.91 arrangements indicated, recognizing that work may be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturers' methods of achieving specified results.
- D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.
- E. Install equipment according to manufacturers' written instructions.
- F. Install wiring and cabling between equipment and related devices.
- G. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference of adjacent other installations.
- H. Provide access panel or doors where units are concealed behind finished surfaces.
- I. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.
- J. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.
- K. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.
- L. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of COR and code requirements.
- M. Install equipment and cabling to distribute equipment loads on building structural members provided for equipment support under other sections; install and support roof-mounted equipment on structural steel or roof curbs as appropriate.
- N. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

3.3 EQUIPMENT INSTALLATION

- A. Locate equipment as close as practical to locations shown on drawings.
- B. Note locations of equipment requiring access on record drawings.
- C. Access and Access Panels: Verify access panel locations and construction with COR.
- D. Inaccessible Equipment:
 - 1. Where Government determines that contractor has installed equipment not conveniently accessible for operation and maintenance, equipment must be removed and reinstalled as directed and without additional cost to Government.
 - 2. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for communication equipment cabinet assembly.
 - 3. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for equipment labeling.

3.4 EQUIPMENT IDENTIFICATION

- A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.
- B. Secure identification signs with screws.

3.5 CUTTING AND PATCHING

- A. Perform cutting and patching according to contract general requirements and as follows:
Requirements for Communications Installations

1. Remove samples of installed work as specified for testing.
 2. Remove and replace defective work.
 3. Remove and replace non-conforming work.
- B. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
- C. Protect adjacent installations during cutting and patching operations.
- D. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

3.6 FIELD QUALITY CONTROL

- A. Provide work according to VAAR 852.236.91 and FAR clause 52.236-5.
- B. Provide minimum clearances and work required for compliance with NFPA 70, National Electrical Code (NEC), and manufacturers' instructions; comply with additional requirements indicated for access and clearances.
- C. Verify all field conditions and dimensions that affect selection and provision of materials and equipment, and provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment.
1. Protect facility, equipment, and wiring from damage.
- D. Submit written notice that:
1. Project has been inspected for compliance with documents.
 2. Work has been completed in accordance with documents.
- E. Non-Conforming Work: Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.
- F. For project acceptance inspections, final completion inspections, substantial completion inspections, and testing/demonstrations that require more than one site visit by COR or design professional to verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.
1. COR will notify contractor, of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits.
 2. Contractor is not be eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.
- G. Tests:
1. Interim inspection is required at approximately 50 percent of installation.
 2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection must verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.
 3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.
 4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.

5. Verify cabling terminations in DEMARC, MCR, TER, SCC, ECC, TRs and head end rooms, workstation locations and TCO adhere to color code for T568B pin assignments and cabling connections are in compliance with TIA standards.
 6. Visually confirm minimum Category 6 cable marking at TCOs, CCSs locations, patch cords and origination locations.
 7. Review entire communications circulating ground system, each TGB and grounding connection, grounding electrode and outside lightning protection system.
 8. Review cable tray, conduit and path/wire way installation practice.
 9. OEM and contractor to perform:
 10. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
 11. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
 12. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
 13. Relocate failed cable reels to a secured location for inventory, as directed by COR, and then remove from project site within two working days; provide COR with written confirmation of defective cable reels removal from project site.
 14. Provide results of interim inspections to COR.
 15. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
 16. Additional inspections are scheduled at direction of COR.
 17. Re-inspection of deficiencies noted during interim inspections, must be part of system's Final Acceptance Proof of Performance Test.
 18. The interim inspection cannot affect the system's completion date unless directed by COR.
 19. Facility COR will ensure test documents become a part of system's official documentation package.
- H. Pretesting: Re-align, re-balance, sweep, re-adjust and clean entire system and leave system working for a "break-in" period, upon completing installation of system and prior to Final Acceptance Proof of Performance Test. System RF transmitting equipment must not be connected to keying or control lines during "break-in" period.
1. Pretesting Procedure:
 2. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
 3. Pretest and verify system functions and performance requirements conform to construction documents and, that no unwanted physical, aural and electronic effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise are present.
 4. Measure and record signal, aural and control carrier levels of each DAS RF, voice and data channel, at each of the following minimum points in system:
 5. Utility provider entrance.
 6. Buried conduit duct locations.
 7. Maintenance Holes (Manholes) and hand holes.
 8. ENTR or DEMARC.
 9. PBX interconnections.
 10. MCR interconnections.
 11. MCOR interconnections.
 12. TER interconnections.
 13. TOR interconnections.
 14. Control room interconnections.
 15. TR interconnections.
 16. System interfaces in locations listed herein.
 17. HE interconnections.
 18. Antenna (outside and inside) interconnections.

19. System and lightning ground interconnections.
20. Communications circulating ground system.
21. UPS areas.
22. Emergency generator interconnections.
23. Each general floor areas.
24. Others as required by AHJ (SMCS 005OP2H3).
25. Provide recorded system pretest measurements and certification that the system is ready for formal acceptance test to COR.

I. Acceptance Test:

1. Schedule an acceptance test date after system has been pretested, and pretest results and certification submitted to COR.
2. Give COR fifteen working days written notice prior to date test is expected to begin; include expected duration of time for test in notification.
3. Test in the presence of the following:
4. COR.
5. OEM representatives.
6. VACO:
 - 1) CFM representative.
 - 2) AHJ–SMCS 005OP2H3, (202)461-5310.
7. VISN–CIO, Network Officer and VISN representatives.
8. Facility:
 - 1) FMS Service Chief, Bio-Medical Engineering and facility representatives.
 - 2) OI&T Service Chief and OI&T representatives.
 - 3) Safety Officer, Police Chief and facility safety representatives.
9. Local Community Safety Personnel:
 - 1) Fire Marshal representative.
 - 2) Disaster Coordinator representative.
 - 3) EMS Representatives: Police, Sherriff, City, County or State representatives.
10. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
11. Rate system as acceptable or unacceptable at conclusion of test; make only minor adjustments and connections required to show proof of performance.
 - 1) Demonstrate and verify that system complies with performance requirements under operating conditions.
 - 2) Failure of any part of system that precludes completion of system testing, and which cannot be repaired within four hours, terminates acceptance test of that portion of system.
 - 3) Repeated failures that result in a cumulative time of eight hours to affect repairs is cause for entire system to be declared unacceptable.
 - 4) If system is declared unacceptable, retesting must be rescheduled at convenience of Government and costs borne by the contractor.

J. Acceptance Test Procedure:

1. Physical and Mechanical Inspection: The test team representatives must tour major areas to determine system and sub-systems are completely and properly installed and are ready for acceptance testing.
2. A system inventory including available spare parts must be taken at this time.
3. Each item of installed equipment must be re-checked to ensure appropriate NRTL (i.e. UL) certification listing labels are affixed.
4. Confirm that deficiencies reported during Interim Inspections and Pretesting are corrected prior to start of Acceptance Test.
5. Inventory system diagrams, record drawings, equipment manuals, pretest results.
6. Failure of system to meet installation requirements of specifications is grounds for terminating testing and to schedule re-testing.

- K. Operational Test:
 - 1. Individual Item Test: VACO AHJ representative (SMCS 005OP2H3) may select individual items of DAS equipment for detailed proof of performance testing until 100 percent of system has been tested and found to meet requirements of the construction documents.
 - 2. Government's Condition of Acceptance of System Language:
 - 3. Without Acceptance: Until system fully meets conditions of construction documents, system's ownership, use, operation and warranty commences at Government's final acceptance date.
 - 4. With Conditional Acceptance: Stating conditions that need to be addressed by contractor or OEM and stating system's use and operation to commence immediately while its warranty commences only at Government's agreed final extended acceptance date.
 - 5. With Full Acceptance: Stating system's ownership, use, operation and warranty to immediately commence at Government's agreed to date of final acceptance.
- L. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to results of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.
- M. Proof of Performance Certification:
 - 1. If system is declared acceptable, AHJ (SMCS 005OP2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
 - 2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed, etc.). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
 - 3. If system is declared unacceptable without conditions, rescheduled testing expenses are to be borne by contractor.

3.7 CLEANING

- A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.
- B. Put building and premises in neat and clean condition.
- C. Remove debris on a daily basis.
- D. Remove unused material, during progress of work.
- E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.
- F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.
- G. Perform final cleaning prior to project acceptance by COR.
- H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.
- I. Clean devices internally using methods and materials recommended by manufacturer.
- J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

3.8 TRAINING

- A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

- B. Provide training for equipment or system as required in each associated specification.
- C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

3.9 PROTECTION

- A. Protection of Fireproofing:
 - 1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
 - 2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
 - 3. Patch and repair fireproofing damaged due to cutting or course of work must be performed by installer of fireproofing and paid for by trade responsible for damage.
- B. Maintain equipment and systems until final acceptance.
- C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

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SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section identifies common and general grounding and bonding requirements of communication installations and applies to all sections of Divisions 27 and 28.

1.2 RELATED WORK

- A. Low voltage wiring: Section 27 10 00, STRUCTURED CABLING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Provide plan indicating location of system grounding electrode connections and routing of aboveground and underground grounding electrode conductors.
- C. Closeout Submittals: In addition to Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide the following:
 - 1. Certified test reports of ground resistance.
 - 2. Certifications: Two weeks prior to final inspection, submit following to COR:
 - a. Certification materials and installation is in accordance with construction documents.
 - b. Certification complete installation has been installed and tested.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Grounding and Bonding Conductors:
 - 1. Provide UL 83 insulated stranded copper equipment grounding conductors, with the exception of solid copper conductors for sizes 6 mm² (10 AWG) and smaller. Identify all grounding conductors with continuous green insulation color, except identify wire sizes 25 mm² (4 AWG) and larger per NEC.
 - 2. Provide ASTM B8 bare stranded copper bonding conductors, with the exception of ASTM B1 solid bare copper for wire sizes 6 mm² (10 AWG) and smaller.
- B. Ground Rods:
 - 1. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
 - 2. Provide quantity of rods required to obtain specified ground resistance.
- C. Splices and Termination Components: Provide components meeting or exceeding UL 467 and clearly marked with manufacturer's name, catalog number, and permitted conductor sizes.
- D. Telecommunication System Ground Busbars:
 - 1. Telecommunications Main Grounding Busbar (TMGB):
 - a. 6.4 mm (1/4 inch) thick solid copper bar.
 - b. Minimum 100 mm (4 inches) high and length sized in accordance application requirements and future growth of minimum 510 mm (20 inches) long.
 - c. Minimum thirty predrilled attachment points (two rows of fifteen each) for attaching standard sized two-hole grounding lugs.
 - 1) 27 lugs with 15.8 mm (5/8 inch) hole centers.

- 2) 3 lugs with 25.4 mm (1 inch) hole centers.
 - d. Wall-mount stand-off brackets, assembly screws and insulators for 100 mm (4 inches) standoff from wall.
 - e. Listed as grounding and bonding equipment.
 2. Telecommunications Grounding Busbar (TGB):
 - a. 6.4 mm (1/4 inch) thick solid copper bar.
 - b. Minimum 50 mm (2 inches) high and length sized in accordance application requirements and future growth of minimum 300 mm long (12 inches) long.
 - c. Minimum nine predrilled attachment points (one row) for attaching standard sized two-hole grounding lugs.
 - 1) 6 lugs with 15.8 mm (5/8 inch) hole centers.
 - 2) 3 lugs with 25.4 mm (1 inch) hole centers.
 - d. Wall-mount stand-off brackets, assembly screws and insulators for 100 mm (4 inches) standoff from wall.
 - e. Listed as grounding and bonding equipment.
- E. Equipment Rack and Cabinet Ground Bars:
 1. Solid copper ground bars designed for horizontal mounting to framework of open racks or enclosed equipment cabinets:
 - a. 4.7 mm (3/16 inch) thick by 19.1 mm (3/4 inch) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
 - b. 482 mm (19 inches) or 584 mm (23 inches) EIA/ECA-310-E rack mounting width (as required) for mounting on racks or cabinets.
 - c. Eight 6-32 tapped ground mounting holes on 25.4 mm (1 inch) intervals.
 - d. Four 7.1 mm (0.281 inch) holes for attachment of two-hole grounding lugs.
 - e. Copper splice bar of same material to transition between adjoining racks.
 - f. Two each 12-24 x 19.1 mm (3/4 inch) copper-plated steel screws and flat washers for attachment to rack or cabinet.
 - g. Listed as grounding and bonding equipment.
 2. Solid copper ground bars designed for vertical mounting to framework of open racks or enclosed equipment cabinets:
 - a. 1.3 mm (0.05 inch) thick by 17 mm (0.68 inch) wide tinned copper strip.
 - b. 1997 mm (78 inches) high for mounting vertically on full height racks.
 - c. Holes punched on 15.875 mm-15.875 mm-12.7 mm (5/8"-5/8"-1/2") alternating vertical centers to match EIA/ECA-310-E Universal Hole Pattern for a 45 RMU rack.
 - d. Three #12-24 zinc-plated thread forming hex washer head installation screws, an abrasive pad and antioxidant joint compound.
 - e. NRTL listed as grounding and bonding equipment.
- F. Ground Terminal Blocks: Provide screw lug-type terminal blocks at equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted.
 1. Electroplated tin aluminum extrusion.
 2. Accept conductors ranging from #14 AWG through 2/0.
 3. Hold conductors in place by two stainless steel set screws.
 4. Two 6 mm (1/4 inch) holes spaced on 15.8 mm (5/8 inch) centers to allow secure two-bolt attachment.
 5. Listed as a wire connector.
- G. Splice Case Ground Accessories: Provide splice case grounding and bonding accessories manufactured by splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.
- H. Irreversible Compression Lugs:
 1. Electroplated tinned copper.
 2. Two holes spaced on 15.8 mm (5/8 inch) or 25.4 mm (1 inch) centers.

3. Sized to fit the specific size conductor.
 4. Listed as wire connectors.
- I. Antioxidant Joint Compound: Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Exterior Equipment Grounding: Bond exterior metallic components (including masts and cabinets), antennas, satellite dishes, towers, raceways, primary telecommunications protector/arresters, secondary surge protection, waveguides, cable shields, down conductors and other conductive items to directly to Intersystem Bonding Termination.
- B. Install telecommunications bonding backbone conductor throughout building via telecommunications backbone pathways effectively bonding all interior telecommunications grounding busbars in telecommunications rooms, main computer room to telecommunications main grounding busbar in Demarc room after testing bond to verify bonding conductor for telecommunications from grounding electrode conductor is installed per NEC. Size telecommunications bonding backbone conductor as specified in TIA-607-B.
- C. Inaccessible Grounding Connections: Utilize exothermic welding for bonding of buried or otherwise inaccessible connections with the exception of connections requiring periodic testing.
- D. Conduit Systems:
1. Bond ferrous metallic conduit to ground.
 2. Bond grounding conductors installed in ferrous metallic conduit at both ends of conduit using grounding bushing with #6 AWG conductor.
- E. Boxes, Cabinets, and Enclosures:
1. Bond each pull box, splice box, equipment cabinet, and other enclosures through which conductors pass (except for special grounding systems for intensive care units and other critical units shown) to ground.
 2. Raised Floors: Bonding raised floor components to ground. Refer to details on drawings.
- F. Corrosion Inhibitors: Apply corrosion inhibitor for protecting connection between metals used to contact surfaces, when making ground and ground bonding connections.
- G. Telecommunications Grounding System:
1. Bond telecommunications grounding systems and equipment to facility's electrical grounding electrode at Intersystem Bonding Termination.
 2. Provide hardware as required to effectively bond metallic cable shields communications pathways, cable runway, and equipment chassis to ground.
 3. Install bonding conductors without splices using shortest length of conductor possible to maintain clearances required by NEC.
 4. Provide paths to ground that are permanent and continuous with a resistance of 1 ohm or less from each raceway, cable tray, and equipment connection to telecommunications grounding busbar.
 5. Below-Grade Connections: When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use exothermic welding cartridges and molds in accordance with manufacturer's recommendations. After welds have been made and cooled, brush slag from weld area and thoroughly clean joint areas. Notify COR prior to backfilling at ground connections.
 6. Above-Grade Bolted or Screwed Grounding Connections:
 - a. Remove paint to expose entire contact surface by grinding.
 - b. Clean all connector, plate and contact surfaces.
 - c. Apply corrosion inhibitor to surfaces before joining.
 7. Bonding Jumpers:

Grounding and Bonding for Communications Systems

- a. Assemble bonding jumpers using insulated ground wire of size and type shown on drawings or use a minimum of 16 mm² (6 AWG) insulated copper wire terminated with compression connectors of proper size for conductors.
 - b. Use connector manufacturer's compression tool.
8. Bonding Jumper Fasteners:
- a. Conduit: Connect bonding jumpers using lugs on grounding bushings or clamp pads on push-type conduit fasteners. Where appropriate, use zinc-plated external tooth lockwashers or Belleville Washers.
 - b. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers or Belleville washers and nuts. Install protective cover, e.g., zinc-plated acorn nuts, on bolts extending into wireway or cable tray to prevent cable damage.
 - c. Grounding Busbars: Fasten bonding conductors using two-hole compression lugs. Use 300 series stainless steel bolts, Belleville Washers, and nuts.
 - d. Slotted Channel Framing and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and Belleville washers or external tooth lock washers.
- H. Telecommunications Room Bonding:
1. Telecommunications Grounding Busbars:
 - a. Install busbar hardware no less than 950 mm (18 inches) A.F.F.
 - b. Where other grounding busbars are located in same room, e.g. electrical panelboard for telecommunications equipment, bond busbars together as indicated on grounding riser diagrams.
 - c. Make conductor connections with two-hole compression lugs sized to fit busbar and conductors.
 - d. Attach lugs with stainless steel hardware after preparing bond according to manufacturer recommendations and treating bonding surface on busbar with anti-oxidant to help prevent corrosion.
 2. Telephone-Type Cable Rack Systems:
 - a. Aluminum pan installed on telephone-type cable rack serves as primary ground conductor within communications room.
 - b. Make ground connections by installing bonding jumpers:
 - 1) Install minimum 16 mm² (6 AWG) bonding between telecommunications ground busbars and the aluminum pan installed on cable rack.
 - 2) Install 16 mm² (6 AWG) bonding jumpers across aluminum pan junctions.
- I. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:
1. Install rack-mount horizontal busbar or vertical busbar to provide multiple bonding points,
 2. At each rack or cabinet containing active equipment or shielded cable terminations:
 - a. Bond busbar to ground as part of overall telecommunications bonding and grounding system.
 - b. Bond copper ground bars together using solid copper splice plates manufactured by same ground bar manufacturer, when ground bars are provided at rear of lineup of bolted together equipment racks.
 - c. Bond non-adjacent ground bars on equipment racks and cabinets with 16 mm² (6 AWG) insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.
 - d. Provide 16 mm² (6 AWG) bonding jumpers between rack and cabinet ground busbars and overhead cable runway or raised floor stringers, as appropriate.
- J. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near top of backboards used for communications cross-connect systems. Connect backboard ground terminals to cable runway using an insulated 16 mm² (6 AWG) bonding jumper.
- K. Other Communication Room Ground Systems: Ground metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to cable tray or

telecommunications ground busbar, whichever is closer, using insulated 16 mm² (6 AWG) ground wire bonding jumpers.

L. Communications Cable Grounding:

1. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing or terminating location to provide 100 percent metallic sheath continuity throughout communications distribution system.
2. Install a cable shield bonding connector with a screw stud connection for ground wire, at terminal points. Bond cable shield connector to ground.
3. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or splice case manufacturer's splice case grounding and bonding accessories. When an external ground connection is provided as part of splice closure, connect to an effective ground source and bond all other metallic components and equipment at that location.

M. Communications Cable Tray Systems:

1. Bond metallic structures of cable tray to provide 100 percent electrical continuity throughout cable tray systems.
2. Where metallic cable tray systems are mechanically discontinuous:
 - a. Install splice plates provided by cable tray manufacturer between cable tray sections so resistance across a bolted connection is 0.010 ohms or less, as verified by measuring across splice plate connection.
 - b. Install 16 mm² (6 AWG) bonding jumpers across each cable tray splice or junction where splice plates cannot be used.
3. Bond cable tray installed in same room as telecommunications grounding busbar to busbar.

N. Communications Raceway Grounding:

1. Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to bond metallic conduit at both ends and intermediate metallic enclosures to ground.
2. Cable Tray Systems: Use insulated 16 mm² (6 AWG) grounding jumpers to bond cable tray to column-mounted building ground plates (pads) at both ends and approximately 16 meters (50 feet) on centers.

O. Ground Resistance:

1. Install telecommunications grounding system so resistance to grounding electrode system measures 5 ohms or less.
2. Measure grounding electrode system resistance using an earth test meter, clamp-on ground tester, or computer-based ground meter as defined in IEEE 81. Record ground resistance measurements before electrical distribution system is energized.
3. Backfill only after below-grade connection have been visually inspected by COR. Notify COR twenty-four hours before below-grade connections are ready for inspection.

P. Ground Rod Installation:

1. Drive each rod vertically in earth minimum 3000 mm (10 feet) in depth.
2. Make connections by exothermic process to form solid metal joints, where permanently concealed ground connections are required. Make accessible ground connections with mechanical pressure type ground connectors.
3. Install angled ground rods or grounding electrodes in horizontal trenches to achieve specified resistance, where rock prevents driving of vertical ground rods.

3.2 FIELD QUALITY CONTROL

- A. Perform tests per BICSI's Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.
- B. Perform two-point bond test using trained installers qualified to use test equipment.

- C. Conduct continuity test to verify that metallic pathways in telecommunications spaces are bonded to TGB or TMGB.
- D. Conduct electrical continuity test to verify that TMGB is effectively bonded to grounding electrode conductor.
- E. Visually inspect to verify that screened and shielded cables are bonded to TGB or TMGB.
- F. Perform a resistance test to ensure patch panel, rack and cabinet bonding connection resistance measures less than 5 Ohms to TGB or TMGB.

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SECTION 27 05 33

RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for communications cabling unless shown or specified otherwise.

1.2 RELATED WORK

- A. Bedding of conduits: Section 31 20 00, EARTH MOVING.
- B. Mounting board for Telecommunication Rooms: Section 06 10 00, ROUGH CARPENTRY.
- C. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.
- D. Fabrications for deflection of water away from building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.
- F. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.
- G. 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.

1.3 SUBMITTALS

- A. In accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit the following:
 - 1. Size and location of cabinets, splice boxes and pull boxes.
 - 2. Layout of required conduit penetrations through structural elements.
 - 3. Catalog cuts marked with specific item proposed and area of application identified.
- B. Certification: Provide letter prior to final inspection, certifying material is in accordance with construction documents and properly installed.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Minimum Conduit Size: 19 mm (3/4 inch).
- B. Conduit:
 - 1. Rigid Galvanized Steel: Conform to UL 6, ANSI C80.1.
 - 2. Rigid Aluminum: Conform to UL 6A, ANSI C80.5.
 - 3. Rigid Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
 - 4. Electrical Metallic Tubing (EMT):
 - a. Maximum Size: 105 mm (4 inches).
 - b. Install only for cable rated 600 volts or less.
 - c. Conform to UL 797, ANSI C80.3.
 - 5. Flexible Galvanized Steel Conduit: Conform to UL 1.
 - 6. Liquid-tight Flexible Metal Conduit: Conform to UL 360.

7. Direct Burial Plastic Conduit: Conform to UL 651 and UL 651A, heavy wall PVC, or high density polyethylene (HDPE).
8. Surface Metal Raceway: Conform to UL 5.
9. Wireway, Approved "Basket": Provide "Telecommunications Service" rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.

C. Conduit Fittings:

1. Rigid Galvanized Steel and Rigid Intermediate Steel Conduit Fittings:
 - a. Provide fittings meeting requirements of UL 514B and ANSI/ NEMA FB 1.
 - b. Sealing: Provide threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water and vapor. In concealed work, install sealing fittings in flush steel boxes with blank cover plates having same finishes as other electrical plates in room.
 - c. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
 - d. Locknuts: Bonding type with sharp edges for digging into metal wall of an enclosure.
 - e. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into metallic body of fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - f. Erickson (union-type) and Set Screw Type Couplings:
 - 1) Couplings listed for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete.
 - 2) Use set screws of case hardened steel with hex head and cup point to seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - g. Provide OEM approved fittings.
2. Rigid Aluminum Conduit Fittings:
 - a. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are not permitted.
 - b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
 - c. Set Screw Fittings: Not permitted for use with aluminum conduit.
3. Electrical Metallic Tubing Fittings:
 - a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
 - b. Couplings and Connectors: Concrete tight and rain tight, with connectors having insulated throats.
 - 1) Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller.
 - 2) Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches).
 - 3) Use set screws of case-hardened steel with hex head and cup point to seat in wall of conduit for positive grounding.
 - c. Indent type connectors or couplings are not permitted.
 - d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.
 - e. Provide OEM approved fittings.
4. Flexible Steel Conduit Fittings:
 - a. Conform to UL 514B; only steel or malleable iron materials are acceptable.
 - b. Provide clamp type, with insulated throat.
 - c. Provide OEM approved fittings.
5. Liquid-tight Flexible Metal Conduit Fittings:

- a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
 - b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
 - c. Provide connectors with insulated throats to prevent damage to cable jacket.
 - d. Provide OEM approved fittings.
6. Direct Burial Plastic Conduit Fittings: Provide fittings meeting requirements of UL 514C and NEMA TC3, and as recommended by conduit manufacturer.
 7. Surface Metal Raceway: Conform to UL 5 and "telecommunications service" rated with approved length-way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
 8. Surface Metal Raceway Fittings: As recommended by raceway manufacturer.
 9. Expansion and Deflection Couplings:
 - a. Conform to UL 467 and UL 514B.
 - b. Accommodate 19 mm (3/4 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid sized to ensure conduit ground continuity and fault currents in accordance with UL 467, and NEC code tables for ground conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
 10. Rigid Aluminum Fittings:
 - a. Provide malleable iron, steel or aluminum alloy materials; zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
 - b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
 - c. Set Screw Fittings: Not permitted for use with aluminum conduit.
 - d. Indent type connectors or couplings are prohibited.
 - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.
 - f. Provide OEM approved fittings.
 11. Wireway Fittings: As recommended by wireway OEM.
- D. Conduit Supports:
1. Parts and Hardware: Provide zinc-coat or equivalent corrosion protection.
 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 3. Multiple Conduit (Trapeze) Hangers: Minimum 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 2.78 mm (12 gage) steel, cold formed, lipped channels; with minimum 9 mm (3/8 inch) diameter steel hanger rods.
 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Splice, and Pull Boxes:
1. Conform to UL-50 and UL-514A.
 2. Cast metal where required by NEC or shown, and equipped with rustproof boxes.
 3. Sheet Metal Boxes: Galvanized steel, except where otherwise shown.
 4. Install flush mounted wall or ceiling boxes with raised covers so that front face of raised cover is flush with wall.
 5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.
- F. Wireways: Equip with hinged covers, except where removable covers are shown.
- G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED COMMUNICATIONS CABLE BELOW".
- H. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:

1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway for optical fiber cables and communications cable applications; select in accordance with provisions of NEC Articles 770 and 800.
 2. Provide Communications Raceway with a factory installed 567 kg (1250 lb.) tensile pre-lubricated pull tape.
 3. Use only metallic straps, hangers and fittings to support raceway from building structure. Cable ties are not permitted for securing raceway to building structure.
 4. Provide fittings to be installed in spaces used for environmental air made of materials that do not exceed flammability, smoke generation, ignitability, and toxicity requirements of environmental air space.
 5. Size: Metric Designator 53 (trade size 2) or smaller.
 6. Outside Plant: Plenum-rated where each interduct is 75 mm (3 inches) and larger.
 7. Inside Plant: Listed and marked for installation in plenum airspaces and minimum 25 mm (1 inch) inside diameter.
 8. Plenum: Non-metallic communications raceway.
 - a. Constructed of low smoke emission, flame retardant PVC with corrugated construction.
 - b. UL 94 V-O rating for flame spreading limitation.
 9. Provide innerduct reel lengths as necessary to ensure ducts are continuous; one piece runs from ENTR to MH; MH to MH; DEMARC to MCR/TER; TR to TR. Innerduct connectors are not permitted between rooms.
 10. Provide pulling accessories used for innerduct including but not limited to, inner duct lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (blown air) compatible with materials being pulled.
- I. Outlet Boxes:
1. Flush wall mounted minimum 11.9 cm (4-11/16 inches) square, 9.2 cm (3-5/8 inches) deep pressed galvanized steel.
 2. Flush wall mounted 12.7 cm (5 inches) square x 7.3 cm (2-7/8 inches); deep pressed galvanized steel.
 3. 2-Gang Tile Box:
 - a. Flush backbox type for installation in block walls.
 - b. Minimum 92 mm (3-5/8 inches) deep.
- J. Weatherproof Outlet Boxes: Surface mount two gang, 67 mm (2-5/8 inches) deep weatherproof cast aluminum with powder coated finish internal threads on hubs 19 mm (3/4 inch) minimum.
- K. Cable Tray:
1. Provide wire basket type of sizes indicated; with all required splicing and mounting hardware.
 2. Materials and Finishes:
 - a. Electro-plated zinc galvanized (post plated) made from carbon steel and plated to ASTM B 633, Type III, SC-1.
 - b. Remove soot, manufacturing residue/oils, or metallic particles after fabrication.
 - c. Rounded edges and smooth surfaces.
 3. Provide continuous welded top side wire to protect cable insulation and installers.
 4. High strength steel wires formed into a 50 x 100 mm (2 inches by 4 inches) wire mesh pattern with intersecting wires welded together.
 5. Wire Basket Sizes:
 - a. Wire Diameter: 5 mm (0.195 inch) minimum on all mesh sections.
 - b. Usable Loading Depth: 105 mm (4 inch) 150 mm (6 inches) .
 - c. Width: 300 mm (12 inches) 450 mm (18 inches).
 6. Fittings: Field-formed, from straight sections, in accordance with manufacturer's instructions.
 7. Provide accessories to protect, support and install wire basket tray system.
- L. Cable Duct: Equip with hinged covers, except where removable covers are accepted by COR.

M. Cable Duct Fittings: As recommended by cable duct OEM.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Raceways typically required for cabling systems unless otherwise indicated:

System	Specification Section	Installed Method
Grounding	27 05 26	Conduit Not Required
Control, Communication and Signal Wiring	27 10 00	Complete Conduit Allowed in Non-Partitioned Cable Tray or Cable Ladders
Communications Structured Cabling	27 15 00	Conduit to Cable Tray Partitioned Cable Tray
Master Antenna Television Equipment and Systems	27 41 31	Conduit to Cable Tray, Partitioned Cable Tray
Public Address and Mass Notification Systems	27 51 16	Complete conduit
Intercommunications and Program systems	27 51 23	Conduit to Cable Tray, Partitioned Cable Tray
Nurse Call	27 52 23	Complete Conduit
Security Emergency Call, Duress Alarm, and Telecommunications	27 52 31	Conduit to Cable Tray, Partitioned Cable Tray
Miscellaneous Medical Systems	27 52 41	Complete Conduit
Distributed Radio Antenna Equipment and System	27 53 19	Conduit to Cable Tray, Partitioned Cable Tray
Grounding and Bonding for Electronic Safety and Security	28 05 26	Conduit Not Required Unless Required by Code
Physical Access Control System	28 13 00	Conduit to Cable Tray Partitioned Cable Tray
Physical Access Control System and Database Management	28 13 16	Conduit to Cable Tray Partitioned Cable Tray
Security Access Detection	28 13 53	Complete Conduit
Intrusion Detection System	28 16 00	Conduit to Cable Tray, Partitioned Cable Tray
Video Surveillance	28 23 00	Complete Conduit
Electronic Personal Protection System	28 26 00	Conduit to Cable Tray, Partitioned Cable Tray
Fire Detection and Alarm	28 31 00	Complete Conduit

B. Penetrations:
 1. Cutting or Holes:

- a. Locate holes in advance of installation. Where they are proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.
- b. Make holes through concrete and masonry in new structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not permitted; COR may grant limited permission by request, in condition of limited working space.
- c. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
 - 1) Fill and seal clearances between raceways and openings with fire stop material.
 - 2) Install only retrofittable, non-hardening, and reusable firestop material that can be removed and reinstalled to seal around cables inside conduits.
- d. Waterproofing at Floor, Exterior Wall, and Roof Conduit Penetrations:
 - 1) Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS or directed by waterproofing manufacturer.

C. Conduit Installation:

1. Minimum conduit size of 19 mm (3/4 inch), but not less than size required for 40 percent fill.
2. Install insulated bushings on all conduit ends.
3. Install pull boxes after every 180 degrees of bends (two 90 degree bends). Size boxes per TIA 569.
4. Extend vertical conduits/sleeves through floors minimum 75 mm (3 inches) above floor and minimum 75 mm (3 inches) below ceiling of floor below.
5. Terminate conduit runs to and from a backboard in a closet or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
6. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.
7. Seal empty conduits located in telecommunications rooms or on backboards with a standard non-hardening putty compound to prevent entrance of moisture and gases and to meet fire resistance requirements.
8. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

9. Provide 19 mm (3/4 inch) thick fire retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on wall of communication closets where shown on drawings.

Mount plywood with bottom edge 300 mm (12 inches) above finished floor and top edge 2.74 m (9 feet) A.F.F.

10. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
11. Complete each entire conduit run installation before pulling in cables.
12. Flattened, dented, or deformed conduit is not permitted.
13. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
14. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
15. Install conduit mechanically continuous.
16. Independently support conduit at 2.44 m (8 feet) on center; do not use other supports (i.e., suspended ceilings, suspended ceiling supporting members, luminaires, conduits, mechanical piping, or mechanical ducts).
17. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
18. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
19. Attach conduits to cabinets, splice cases, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on inside of enclosure, made up wrench tight. Do not make conduit connections to box covers.
20. Do not use aluminum conduits in wet locations.
21. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors and ceilings.
22. Conduit Bends:
 - a. Make bends with standard conduit bending machines; observe minimum bend radius for cable type and outside diameter.
 - b. Conduit hickey is permitted only for slight offsets, and for straightening stubbed conduits.
 - c. Bending of conduits with a pipe tee or vise is not permitted.
23. Layout and Homeruns - Deviations: Make only where necessary to avoid interferences and only after drawings showing proposed deviations have been submitted and approved by COR.

D. Concealed Work Installation:

1. In Concrete:
 - a. Conduit: Rigid steel or IMC.
 - b. Align and run conduit in direct lines.
 - c. Install conduit through concrete beams only when the following occurs:
 - 1) Where shown on structural drawings.
 - 2) As accepted by COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
 - d. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
 - 1) Conduit outside diameter larger than 1/3 of slab thickness is prohibited.
 - 2) Space between Conduits in Slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
 - 3) Install conduits approximately in center of slab to ensure a minimum of 19 mm (3/4 inch) of concrete around conduits.
 - e. Make couplings and connections watertight. Use thread compounds that are NRTL listed conductive type to ensure low resistance ground continuity through conduits. Tightening set screws with pliers is not permitted.

E. Furred or Suspended Ceilings and in Walls:

1. Rigid steel, IMC or rigid aluminum. Different type conduits mixed indiscriminately in same system is not permitted.
2. Align and run conduit parallel or perpendicular to building lines.
3. Tightening set screws with pliers is not permitted.

- F. Exposed Work Installation:
1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
 - a. Provide rigid steel, IMC or rigid aluminum.
 - b. Different type of conduits mixed indiscriminately in system is not permitted.
 2. Align and run conduit parallel or perpendicular to building lines.
 3. Install horizontal runs close to ceiling or beams and secure with conduit straps.
 4. Support horizontal or vertical runs at not over 2400 mm (96 inches) intervals.
 5. Surface Metal Raceways: Use only where shown on drawings.
 6. Painting:
 - a. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
 - b. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color.
 - c. Provide labels where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.
- G. Expansion Joints:
1. Conduits 75 mm (3 inches) and larger, that are secured to building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with manufacturer's recommendations.
 2. Provide conduits smaller than 75 mm (3 inches) with pull boxes on both sides of expansion joint. Connect conduits to expansion and deflection couplings as specified.
 3. Install expansion and deflection couplings where shown.
- H. Seismic Areas:
1. In seismic areas, follow H-18-8 Seismic Design Requirements.
 2. Rigidly secure conduit to building structure on opposite sides of a building expansion joint with pull boxes on both sides of joint.
 3. Connect conduits to pull boxes with 375 mm (15 inches) of slack flexible conduit.
 4. Install green copper wire minimum #6 AWG in flexible conduit for bonding jumper.
- I. Conduit Supports, Installation:
1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
 2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
 3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other accepted fasteners.
 4. Support conduit independent of pull boxes, luminaires, suspended ceiling components, angle supports, duct work, and similar items.
 5. Fastenings and Supports in Solid Masonry and Concrete:
 - a. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing concrete.
 - b. Existing Construction:
 - 1) Code AC193 listed wedge type steel expansion anchors minimum 6 mm (1/4 inch) bolt size and minimum 28 mm (1-1/8 inch) embedment.
 - 2) Power set fasteners minimum 6 mm (1/4 inch) diameter with depth of penetration minimum 75 mm (3 inches).
 - 3) Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
 6. Fastening to Hollow Masonry: Toggle bolts are permitted.
 7. Fastening to Metal Structures: Use machine screw fasteners or other devices designed and accepted for application.
 8. Bolts supported only by plaster or gypsum wallboard are not acceptable.

9. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
10. Do not support conduit from chain, wire, or perforated strap.
11. Spring steel type supports or fasteners are not permitted except horizontal and vertical supports/fasteners within walls.
12. Vertical Supports:
 - a. Install riser clamps and supports for vertical conduit runs in accordance with NEC.
 - b. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

J. Box Installation:

1. Boxes for Concealed Conduits:
 - a. Flush mounted.
 - b. Provide raised covers for boxes to suit wall or ceiling, construction and finish.
2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.
3. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum 600 mm (24 inches) center-to-center lateral spacing must be maintained between boxes.

K. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:

1. Install supports from building structure for horizontal runs at intervals not to exceed 900 mm (3 feet) and at each end.
2. Install supports from building structure for vertical runs at intervals not to exceed 1.2 m (4 feet) and at each side of joints.
3. Install only in accessible spaces not subject to physical damage or corrosive influences.
4. Make bends manually to assure internal diameter of tubing is not effectively reduced.
5. Extend each segment of innerduct minimum 300 mm (12 inches) beyond end of service conduit tie or cable tray. Restrain innerduct ends with wall mount clamps and seal when cable is installed.

3.2 TESTING

- A. Examine fittings and locknuts for secureness.
- B. Test RMC, IMC and EMT systems for electrical continuity.
- C. Perform simple continuity test after cable installation.

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SECTION 27 08 00

COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes requirements for commissioning facility communications systems, related subsystems and related equipment. This Section supplements general requirements specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
- B. Complete list of equipment and systems to be commissioned is specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Specification 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Commissioned Systems:
 - 1. Commissioning of systems specified in Division 27 and 28 is part of project's construction process including documentation and proof of performance testing of these systems, as well as training of VA's Operation and Maintenance personnel in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Division 27, in cooperation with Government and Commissioning Agent.
 - 2. The facility exterior closure systems commissioning includes communications systems listed in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS and 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.2 RELATED WORK

- A. System tests: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Commissioning process requires review of selected submittals that pertain to systems to be commissioned: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- C. Construction phase commissioning process and procedures including roles and responsibilities of commissioning team members and user training: Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

1.3 COORDINATION

- A. Commissioning Agent will provide a list of submittals that must be reviewed by Commissioning Agent simultaneously with engineering review; do not proceed with work of sections identified without engineering and Commissioning Agent's review completed.
- B. Commissioning of communications systems require inspection of individual elements of communications system construction throughout construction period. Coordinate with Commissioning Agent in accordance with Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and commissioning plan to schedule communications systems inspections as required to support the commissioning process.

1.4 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for pre-functional checklists, equipment startup reports, and other commissioning documents.
- B. Pre-Functional Checklists:
 - 1. Complete pre-functional checklists provided by commissioning agent to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing.

2. Submit completed checklists to COR and to Commissioning Agent. Commissioning Agent can spot check a sample of completed checklists. If Commissioning Agent determines that information provided on the checklist is not accurate, Commissioning Agent then returns the marked-up checklist to Contractor for correction and resubmission.
 3. If Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, Commissioning Agent can select a broader sample of checklists for review.
 4. If Commissioning Agent determines that a significant number of broader sample of checklists is also inaccurate, all checklists for the type of equipment will be returned to Contractor for correction and resubmission.
- C. Submit training agendas and trainer resumes in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Contractor's Tests:
1. Scheduled tests required by other sections of Division 27 must be documented in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
 2. Incorporate all testing into project schedule. Provide minimum seven calendar days' notice of testing for Commissioning Agent to witness selected Contractor tests at sole discretion of Commissioning Agent.
 3. Complete tests prior to scheduling Systems Functional Performance Testing.
- B. Systems Functional Performance Testing:
1. Commissioning process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions.
 2. Commissioning Agent prepares detailed Systems Functional Performance Test procedures for review and acceptance by COR.
 3. Provide required labor, materials, and test equipment identified in test procedure to perform tests.
 4. Commissioning Agent must witness and document the testing.
 - a. Provide test reports to Commissioning Agent. Commissioning Agent will sign test reports to verify tests were performed.

3.2 TRAINING

- A. Training of Government's operation and maintenance personnel is required in cooperation with COR and Commissioning Agent.
- B. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning location, operation, and troubleshooting of installed systems.
- C. Schedule instruction in coordination with COR after submission and approval of formal training plans.

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SECTION 27 10 00

CONTROL, COMMUNICATION AND SIGNAL WIRING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes control, communication and signal wiring for a comprehensive systems infrastructure.
- B. This section applies to all sections of Divisions 27 and 28.

1.2 RELATED WORK

- A. Excavation and backfill for cables that are installed in conduit: Section 31 20 00, EARTH MOVING.
- B. Sealing around penetrations to maintain integrity of time rated construction: Section 07 84 00, FIRESTOPPING.
- C. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- E. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Submit written certification from OEM:
 - 1. Indicate wiring and connection diagrams meet National and Government Life Safety Guidelines, NFPA, NEC, NRTL, Joint Commission, OEM, this section and Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
 - 2. Include instructions, requirements, recommendations, and guidance for proper performance of system as described herein.
 - 3. Government will not approve any submittal without this certification.
- C. Identify environmental specifications on technical submittals; identify requirements for installation.
 - 1. Minimum floor space and ceiling heights.
 - 2. Minimum size of doors for cable reel passage.
- D. Power: Provide specific voltage, amperage, phases, generator equipment and quantities of circuits.
- E. Provide conduit size requirements.
- F. Closeout Submittals:
 - 1. Provide contact information for maintenance personnel to contact contractor for emergency maintenance and logistic assistance, and assistance in resolving technical problems at any time during warranty period.
 - 2. Provide certified OEM sweep test tags from each cable reel to COR.

3. Furnish spare or unused wire and cable with appropriate connectors (female types) for installation in appropriate punch blocks, barrier strips, patch, or bulkhead connector panels.
4. Turn over unused and opened installation kit boxes, coaxial, fiber optic, and twisted pair cable reels, conduit, cable tray, cable duct bundles, wire rolls, physical installation hardware to COR.
5. Documentation: Include any item or quantity of items, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide system documentation required herein.

PART 2 - PRODUCTS

2.1 CONTROL WIRING

- A. Provide control wiring large enough so voltage drop under in-rush conditions does not adversely affect operation of controls.
- B. Provide cable meeting specifications for type of cable.
- C. Outside Location (i.e. above ground, underground in conduit, ducts, pathways, etc.): Provide cables filled with a waterproofing compound between outside jacket (not touching any provided armor) and inter conductors to seal punctures in jacket and protect conductors from moisture.
- D. Remote Control Cable:
 1. Multi-conductor with stranded conductors able to handle power and voltage required to control specified system equipment, from a remote location.
 2. NRTL listed and pass VW-1 vertical wire flame test (UL 83) (formerly FR-1).
 3. Color-coded Conductors: Combined multi-conductor and coaxial cables are acceptable for this installation, on condition system performance standards are met.
 4. Technical Characteristics:
 - a. Length: As required, in 1K (3,000 ft.) reels minimum.
 - b. Connectors: As required by system design.
 - c. Size:
 - 1) 18 AWG, minimum, Outside.
 - 2) 20 AWG, minimum, Inside.
 - d. Color Coding: Required, EIA industry standard.
 - e. Bend Radius: 10 times cable outside diameter.
 - f. Impedance: As required.
 - g. Shield Coverage: As required by OEM specification.
 - h. Attenuation:

Frequency in MHz	dB per 305 Meter (1,000 feet), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

- E. Distribution System Signal Wires and Cables:
 - 1. Provide in same manner, and use construction practices, as Fire Protective and other Emergency Systems identified and defined in NFPA 101, Life Safety Code, Chapters 7, 12, and 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions.
 - 2. Provide system able to withstand adverse environmental conditions without deterioration, in their respective location.
 - 3. Provide entering of each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of cables.
 - 4. Terminate on an item of equipment by direct connection.

2.2 COMMUNICATION AND SIGNAL WIRING

- A. Provide communications and signal wiring conforming to recommendations of manufacturers of systems ; provide not less than TIA Performance Category 5e .
- B. Wiring shown is for typical systems; provide wiring as required for systems being provided.
- C. Provide color-coded conductor insulation for multi-conductor cables.
- D. Connectors:
 - 1. Provide connectors for transmission lines, and signal extensions to maintain uninterrupted continuity, ensure effective connection, and preserve uniform polarity between all points in system.
 - a. Provide AC barrier strips with a protective cover to prevent accidental contact with wires carrying live AC current.
 - b. Provide punch blocks for signal connection, not AC power. AC power twist-on wire connectors are not permitted for signal wire terminations.
 - 2. Cables: Provide connectors designed for specific size cable and conductors being installed with OEM's approved installation tool. Typical system cable connectors include:
 - a. Audio spade lug.
 - b. Punch block.
 - c. Wirewrap.

2.3 INSTALLATION KIT

- A. Include connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, cable tray, etc., required to accomplish a neat and secure installation.
- B. Terminate conductors in a spade lug and barrier strip, wire wrap terminal or punch block, so there are no unfinished or unlabeled wire connections.
- C. Minimum required installation sub-kits:
 - 1. System Grounding:
 - a. Provide required cable and installation hardware for effective ground path, including the following:
 - 1) Control Cable Shields.
 - 2) Data Cable Shields.
 - 3) Equipment Racks.
 - 4) Equipment Cabinets.
 - 5) Conduits.
 - 6) Ducts.
 - 7) Cable Trays.
 - 8) Power Panels.
 - 9) Connector Panels.
 - 10) Grounding Blocks.
 - b. Bond radio equipment to earth ground via internal building wiring, according to NEC.

2. Wire and Cable: Provide connectors and terminals, punch blocks, tie wraps, hangers, clamps, labels, etc. required to accomplish termination in an orderly installation.
 3. Conduit, Cable Duct, and Cable Tray: Provide 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, cable tray installation in accordance with NEC and documents.
 4. Equipment Interface: Provide any items or quantity of equipment, cable, mounting hardware and materials to interface systems with identified sub-systems, according to OEM requirements and construction documents.
 5. Labels: Provide any item or quantity of labels, tools, stencils, and materials to label each subsystem according to OEM requirements, as-installed drawings, and construction documents.
- D. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:
1. Connector Panels: Flat smooth 3.175 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in cabinet. Install bulkhead equipment connectors on panel to enable cabinet equipment's signal, control, and coaxial cables to be connected through panel. Match panel color to cabinet installed.
 - a. Voice (or Telephone):
 - 1) Provide industry standard Type 110 (minimum) punch blocks for voice or telephone, and control wiring instead of patch panels, each being certified for category 5e, 6.
 - 2) IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS when designed for Category 5e, 6 and the size and type of cable used.
 - 3) Secure punch block strips to OEM designed physical anchoring unit on a wall location in TRS; console, cabinet, rail, panel, etc. mounting is permitted at OEM recommendation and as accepted by COR. Punch blocks are not permitted for Class II or 120 VAC power wiring.
 - 4) 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.
 - b. Digital or High Speed Data:
 - 1) Provide 480 mm (19 inches) horizontal EIA/ECA 310 rack mountable patch panel with EIA/ECA 310 standard spaced vertical mounting holes for digital or high-speed data service CSS, with modular female Category 5E (or on a case by case basis Category 6 6A for specialized powered systems accepted by SMCS 005OP2H3, (202) 461-5310, OI&T and FMS Services, and COR) RJ45 jacks designed for size and type of UTP or F/UTP cable installed in rows.
 - 2) Technical Characteristics:
 - a) Number of Horizontal Rows: Minimum 2.
 - b) Number of Jacks Per Row: Minimum 24.
 - c) Type of Jacks: RJ45.
 - d) Terminal Protector: Required for each used or unused jack.
 - e) Insulation: Required between each row of jacks.

2.4 EXISTING WIRING

- A. Reuse existing wiring only where indicated on plans and accepted by SMCS 005OP2H3.
- B. Only existing wiring that conforms to specifications and applicable codes can be reused; existing wiring that does not meet these requirements cannot be reused and must be removed by contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Install wiring in cable tray or raceway.
 2. Seal cable entering a building from underground, between wire and conduit where cable exits conduit, with non-hardening approved compound.
 3. Wire Pulling:
 - a. Provide installation equipment that prevents cutting or abrasion of insulation during pulling of cables.
 - b. Use ropes made of nonmetallic material for pulling feeders.
 - c. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached to conductors, as accepted by COR.
 - d. Pull multiple cables into a single conduit together.
- B. Installation in Maintenance or Man holes:
1. Install and support cables in maintenance holes on steel racks with porcelain or equal insulators.
 2. Train cables around maintenance hole walls, but do not bend to a radius less than six times overall cable diameter.
 3. Fireproofing:
 - a. Install fireproofing where low voltage cables are installed in same maintenance holes with high voltage cables; also cover low voltage cables with arc proof and fireproof tape.
 - b. Use tape of same type used for high voltage cables, and apply tape in a single layer, one-half lapped or as recommended by manufacturer. Install tape with coated side towards the cable and extend minimum 25 mm (1 inch) into each duct.
 - c. Secure tape in place by a random wrap of glass cloth tape.
- C. Control, Communication and Signal Wiring Installation:
1. Unless otherwise specified in other sections, provide wiring and connect to equipment/devices to perform required functions as indicated.
 2. Install separate cables for each system so that malfunctions in any system does not affect other systems, except where otherwise required.
 3. Group wires and cables according to service (i.e. AC, grounds, signal, DC, control, etc.); DC, control and signal cables can be included with any group.
 4. Form wires and cables to not change position in group throughout the conduit run. Bundle wires and cables in accepted signal duct, conduit, cable ducts, or cable trays neatly formed, tied off in 600 mm to 900 mm (24 inch to 36 inch) lengths to not change position in group throughout run.
 5. Concealed splices are not allowed.
 6. Separate, organize, bundle, and route wires or cables to restrict EMI, channel crosstalk, or feedback oscillation inside any enclosure.
 7. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front), locate AC power, DC and speaker wires or cables on the left; coaxial, control, microphone and line level audio and data wires or cables, on the right.
 8. Provide ties and fasteners that do not damage or distort wires or cables. Limit spacing between tied points to maximum 150 mm (6 inches).
 9. Install wires or cables outside of buildings in conduit, secured to solid building structures.
 10. Wires or cables must be specifically accepted, on a case by case basis, to be installed outside of conduit. Bundled wires or cables must be tied at minimum 460 mm (18 inches) intervals to a solid building structure; bundled wires or cables must have ultra violet protection and be waterproof (including all connections).
 11. Laying wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not permitted.

Control, Communication and Signal Wiring

12. Wires or cables installed outside of conduit, cable trays, wireways, cable duct, etc.:
 - a. Only when authorized, can wires or cables be identified and approved to be installed outside of conduit.
 - b. Provide wire or cable rated plenum and OEM certified for use in air plenums.
 - c. Provide wires and cables hidden, protected, fastened and tied at maximum 600 mm (24 inches) intervals, to building structure.
 - d. Provide closer wire or cable fastening intervals to prevent sagging, maintain clearance above suspended ceilings.
 - e. Remove unsightly wiring and cabling from view, and discourage tampering and vandalism.
 - f. Sleeve and seal wire or cable runs, not installed in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers, with an approved fire retardant sealant.

D. AC Power:

1. Bond to ground contractor-installed equipment and identified Government-furnished equipment, to eliminate shock hazards and to minimize ground loops, common mode returns, noise pickup, crosstalk, etc. for total ground resistance of 0.1 Ohm or less.
2. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted; use these items only for dissipation of internally generated static charges (not to be confused with externally generated lightning) that can be applied or generated outside mechanical and physical confines of system to earth ground. Discovery of improper system grounding is grounds to declare system unacceptable and termination of all system acceptance testing.
3. Cabinet Bus: Extend a common ground bus of at least #10 AWG solid copper wire throughout each equipment cabinet and bond to system ground. Provide a separate isolated ground connection from each equipment cabinet ground bus to system ground. Do not tie equipment ground busses together.
4. Equipment: Bond equipment to cabinet bus with copper braid equivalent to at least #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.

3.2 EQUIPMENT IDENTIFICATION

A. Control, Communication and Signal System Identification:

1. Install a permanent wire marker on each wire at each termination.
2. Identify cables with numbers and letters on the labels corresponding to those on wiring diagrams used for installing systems.
3. Install labels retaining their markings after cleaning.
4. In each maintenance hole (manhole) and handhole, install embossed brass tags to identify system served and function.

B. Labeling:

1. Industry Standard: ANSI/TIA-606-B.
2. Print lettering for voice and data circuits using laser printers; handwritten labels are not acceptable.
3. Cable and Wires (hereinafter referred to as "cable"): Label cables at both ends in accordance with industry standard. Provide permanent labels in contrasting colors. Identify cables matching system Record Wiring Diagrams.
4. Equipment: Permanently labeled system equipment with contrasting plastic laminate or bakelite material. Label system equipment on face of unit corresponding to its source.
5. Conduit, Cable Duct, and Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying system. Label each enclosure according to this standard.

6. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and Record Wiring Diagrams.

3.3 TESTING

- A. Minimum test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on cables in frequency ranges specified.
- B. Tests required for data cable must be made to confirm operation of this cable at minimum 10 Mega (M) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of 10⁻⁶ at maximum rate of speed.
- C. Provide cable installation and test records at acceptance testing to COR and thereafter maintain in facility's telephone switch room.
- D. Record changes (used pair, failed pair, etc.) in these records as change occurs.
- E. Test cables after installation and replace any defective cables.

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SECTION 27 11 00

TELECOMMUNICATIONS ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies equipment cabinets, interface enclosures, relay racks, and associated hardware in service provider DEMARC, computer and telecommunications rooms.
- B. Telephone system is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Adhere to Seismic reference standards for systems connecting to or extending telephone system and cabling.

1.2 RELATED WORK

- A. Wiring devices: Section 26 27 26, WIRING DEVICES.
- B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. 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.
- D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- E. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.
- F. Voice communication switching and routing equipment: Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT.

1.3 SUBMITTALS

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATION.
- B. Separate submittal into sections for each subsystem containing the following:
 - 1. Pictorial layouts of each Telecommunications Room and Cross Connection Space (VCCS, and HCCS termination cabinets), each distribution cabinet layout, and TCO as each is expected to be installed and configured.
 - 2. Equipment technical literature detailing electrical and technical characteristics of each item of equipment to be furnished.
- C. Environmental Requirements: Identify environmental specifications for housing system as initial and expanded system configurations.
 - 1. Floor loading for batteries and cabinets.
 - 2. Minimum floor space and ceiling height.
 - 3. Minimum door size for equipment passage.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide components of cabinet system (cabinet, thermal, cable and power management accessories) from a single manufacturer.
- B. Equipment Standards and Testing:

1. Equipment must be listed by a NRTL where a UL standard is in existence; active and passive equipment must conform with each UL standard in effect for equipment, on the submittal date.
2. Each item of electronic equipment must be labeled by a NRTL that warrants equipment has been tested in accordance with, and conforms to specified standards.

C. Equipment Cabinets (Enclosures):

1. Fully enclose and physically secure internally mounted and connected, active and passive equipment.
2. Types of Equipment Enclosures accepted for specific VA Spectrum Management, FMS and OI&T applications in CFM and Facility Projects:

CABINET	FUNCTION
Communications	FMS Special Communications Equipment
Server / Router	OI&T Data/LAN/WAN Equipment
Seismic	Either FMS or OI&T use, specify need
Environmental	Either FMS or OI&T use, specify need

3. Each cabinet to be:
 - a. Provided in head end, MCR, TER, PCR, EMGR, each TR at a minimum.
 - b. Fabricated with minimum 1.59 mm (16 gauge) steel.
 - c. Provided with manufacturer's standard painted finish in a color accepted by COR with concurrence from FMS Service Chief.
 - d. Mounted on floor or wall .
 - e. Lockable; tubular locks keyed alike. Provide six keys to COR for each cabinet.
4. Provide equipment mounting shelves; attach to front and rear mounting rails and allowing equipment to be secured to respective mounting rails.
5. Each enclosure to include:
 - a. Floor or wall mounting.
 - b. Knock out holes for conduit connections or cable entrance.
 - c. Front and rear locking doors; wall mounted cabinets require only front locking door.
 - d. Power outlet strips.
6. Provide quiet ventilation fan with non-disposable locally cleanable air filter.
7. Size each cabinet in order to contain and maintain internal mounted equipment items.
8. Provide OEM's fully assembled unit.
9. Provide OEM assembled side-by-side enclosures in a single unit, at locations requiring more than two enclosures.
10. Provide minimum one cabinet with blank rack space, for additional system expansion equipment.
11. Bond to communications circulating grounding system.
12. Technical Characteristics:
 - a. External:
 - 1) Overall Height:
 - a) Communications/Server: Maximum 2,184 mm (86 inches).
 - b) Seismic: Maximum 1,905 mm (75 inches).
 - 2) Overall Depth:
 - a) Communications/Server: Maximum 914 mm (36 inches).
 - b) Seismic: Maximum 762 mm (30 inches).
 - 3) Overall Width - All: Maximum 864 mm (34 inches).
 - b. Front Panel Openings:
 - 1) Width:
 - a) Communications: 482.6 mm (19 inches), per EIA.
 - b) Server: 483 mm (19 inches), per EIA/ECA 310.
584 mm (23 inches), per EIA/ECA 310.
Seismic: 483 mm (19 inches), per EIA/ECA 310.
 - 2) Height:

- a) Communications/Server: Maximum 2,000 mm (78-3/4 inches or 45 Rack Units, RU), per EIA/ECA 310.
 - b) Seismic: Maximum 1,689 mm (66-1/2 inches or 38 RUs, per EIA/ECA 310).
 - c. Heavy Duty Cycle: Maximum 544 kilograms (1,200 pounds) capacity.
 - d. Certification:
 - 1) NRTL (i.e. UL): For communications and server cabinets.
 - 2) Telcordia Technologies: #63-GR-CORE, (2012) for seismic cabinets.
 - 3) Seismic: Provide cabinet OEM constructed to seismic design category.
13. Cabinet Internal Components:
- a. AC Power:
 - 1) Standard "Quad AC Box":
 - a) Power capacity: 20 Ampere, single phase, 120 VAC continuous duty.
 - b) Wire gauge: #12 AWG, solid copper, connected to room's internal AC Power Panel, or as directed by COR.
 - c) Number of AC power outlets: Minimum 4 receptacles.
 - d) Enclosure: Fully self-contained, metal 102 mm (4 inch) x 102 mm (4 inches) x 64 mm (2-1/2 inches) with cover
 - e) Connection: Minimum 25.4 mm (1 inch) conduit connected to room's AC Power Panel, or as directed by COR
 - f) Number of boxes: One.
 - g) Compliance: NRTL (i.e. UL); NPFA - 70 (NEC).
 - b. AC Outlet Strips:
 - 1) Power Capacity: 15 Ampere, single phase, 120 VAC continuous duty.
 - 2) Wire Gauge: Minimum #12 AWG, solid copper.
 - 3) Number of AC Power Outlets: Minimum 10 "U" grounded.
 - 4) Enclosure: Fully self-contained; typically metal.
 - 5) Connecting Wire: Minimum 2 m (6 feet) long, with three prong self-grounding AC plug connected to cabinet's internal AC "Quad" box.
 - 6) Number of Strips: 2.
 - 7) Certification: NRTL (i.e. UL).
 - c. AC Power Line Surge Protector and Filter Construction:
 - 1) Input Voltage Range: 120 VAC + 15 percent at 50/60 Hz, single phase.
 - 2) Power Service Capacity: 20 AMP, 120 VAC.
 - 3) Voltage Output Regulation: +5.0 percent, instantaneous of input.
 - 4) Circuit Breaker: 15 AMP; may be self-contained.
 - 5) AC Outlets: Minimum four duplex grounded NEMA 5-20R.
 - 6) Response Time: 5.0 nanosecond.
 - 7) Suppression: Isolate and filter any noise, surge spikes
 - a) Surge: Minimum 20,000 AMP.
 - b) Noise:
 - 8) Common: -40 dB.
 - 9) Differential: -45 dB.
 - 10) Clamping Voltage: Minimum 300 V.
 - 11) Enclosure: One; self-contained.
 - 12) Mounting: Internal to cabinet floor or on internal mounting rail shelf, allowing two plugs from two plug strips.
 - 13) AC Power Cord: Required; minimum 1,628 mm (6 feet), three wire (green ground); minimum #14 AWG stranded.
 - 14) Compliance: NRTL (i.e. UL60950-1).
 - d. Uninterruptible Power Supply (UPS): Provide each cabinet with an internal UPS which may be combined with surge protector and filter if system's 50 percent expansion requirement is met. Provide at least one hour continuous full load two hours if working with a emergency uninterruptible system primary AC Power, with

a 50 percent 30 min respectively in the event of facility primary or emergency AC power failure.

- 1) UPS to include:
 - a) On-Off Switch: This function is required to be a part of system's electronic supervision requirements.
 - b) First/Fast Charge Unit: Must provide clean predicable charge voltage/current. Function is required to be a part of system's electronic supervision requirements.
 - c) Over Voltage/Current Protect: Cannot short circuit AC power line at any time. This function is required to be a part of system's electronic supervision requirements.
 - d) Trickle Charge Unit: Must be capable of maintaining a suitable internal battery charge without damaging batteries.
 - e) Mounting: Provide per OEM's direction.
 - f) Proper Ventilation: Do not override cabinets' ventilation system.
 - g) Power Change from AC Input: Accomplish change without interruption to communications link or subsystem being protected. Generate visual and aural alarms in electrical supervision system, local and remote, to annunciating panels via direct connection for trouble indication.
 - 2) Specific requirements for current and surge protection to include:
 - a) Voltage Protection: Threshold, line to neutral, starts at maximum 200 Volts peak. Transient voltage cannot exceed 330 Volts peak. Furnish documentation on peak clamping Voltage as a function of transient waveform.
 - b) Peak Power Dissipation: Minimum 35 Joules per phase, as measured for 1.0 millisecond at sub branch panels, 100 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. Typically, power dissipation is 12,000 Watts (W) for 1.0 mS (or 12 Joules). Provide explanation of how ratings were measured or empirically derived.
 - c) Surge Protector (may be combined with On-Off switch of UPS): Must not short circuit AC power line at any time.
 - 3) Components must be minimum silicon semi-conductors.
 - 4) Secondary stages, if used, may include other types of rugged devices.
 - 5) Indicators: Provide visual device indicating surge suppression component is functioning.
 - 6) Electrical Supervision: Required; must be audible and visual, local and remote to annunciating panels via direct connection for trouble indication.
 - a) Provide current and surge protection on ancillary equipment.
 - b) Equip each cabinet with the following:
 - 7) Equipment Mounting Rails (Front & Rear): Fully adjustable internal equipment mounting rails allowing front or rear equipment mounting with pre-drilled EIA/ECA 310-E Standard tapped holes. Support entire equipment by supplementary support in addition to face mounting screws on rails.
 - 8) Cabinet Ground: Stainless steel adjustable, lug connected to cabinet's main structure providing an internal cabinet ground for all installed equipment properly bolted to rail and with ground wire connected.
 - 9) Grounding Terminals: A separate mounting hole on equipment mounting rail, with stainless steel connecting bolt bonded by minimum #10 AWG copper wire to cabinet's internal grounding lug.
14. Ground Interconnection: Bond cabinet's common grounding lug to room's communications circulating ground busbar with a minimum #4 AWG stranded copper wire.
15. Blank Panels: Provide at every unused rack space.

- a. Match cabinet color.
 - b. Provide panels of 3 mm (1/8 inch) thick aluminum with vertical dimensions in increments of one rack unit (RMU) or 45 mm (1-3/4 inch) with mounting holes spaced to correspond to EIA/ECA 310-E Standard 483 mm (19 inch) rack dimensions.
 - c. Fill large unused openings with single standard large panel instead of numerous types.
 - d. Leave one blank rack space (RMU), covered with a blank panel, between each item of equipment, for minimum internal air flow.
 - e. Leave 356 mm (14 inches)(8.0 RMU) open space, covered with blank cover panel, for additional expansion equipment.
 - f. Wire Management: System that connects each item of installed equipment to room wire management system.
 - g. Knock-out Holes: Provide for cable entrance/exits via conduits, cable duct/trays.
- D. Environmental Cabinet:
1. Enclosure must fully contain installed equipment, including electronics, in same manner as standard cabinet. Provide climate control for installed equipment as if they were in a standalone air handling area, regardless of local area air handling capabilities.
 2. Provide an OEM's fully assembled unit enclosure.
 3. If more than two enclosures are required in any system location, provide OEM-assembled enclosures, in a single unit, side-by-side.
 4. Technical Characteristics:
 - a. Environmental Control: Automatic, heating and cooling as required.
 - b. Temperature Conditions (rated at 1,300 W of install equipment heat generation):
 - 1) Internal Range: Maintains 26.67 degree to 37.78 degree C (80 degree to 100 degree f) of internal heat conditions.
 - 2) External Range: Maximum 37.78 degrees + -3.89 degrees C (100 degrees + 25 degrees F).
 - c. Forced Air Unit: Required with non-disposable air filter; unobstructed and uninterruptible.
 - d. Air Conditioning: As required; fully internal mounted.
 - e. Heater: As required; fully internal mounted.
 - f. UPS: Required; fully internal mounted.
 - g. Front Door: Full length, see through, EMI resistant and lockable, keyed alike with 7-pin tubular lock and Police Service SMS card access .
 - h. Rear door: Full length, see through, EMI resistant, and lockable keyed alike with 7-pin tubular lock and Police Service SMS card access .
 - i. Conduit Wiring Entrance: Top or bottom; fully sealed.
 - j. Input Power: Minimum 2 each; maximum 120 VAC at 20A, independent circuit, conduit for fixed or armored cable for moveable installations.
 - k. Dimensions:
 - 1) Height: Maximum 1980 mm (78 inches).
 - 2) Width: Maximum 635 mm (25 inches).
 - 3) Depth: Maximum 965 mm (38 inches).
 - 4) Front Panel Opening: 480 mm (19 inches), w/ EIA/ECA 310 mounting hole spacing.
 - l. Trouble Annunciator Panel: Refer to specific requirements in equipment cabinet.
 - m. Audio Monitor Panel: Refer to specific requirements in equipment cabinet.
- E. Wall Mounted Distribution or System Interface Cabinet:
1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel, with top, side and bottom panels.
 2. Provide double-hinged front door and main cabinet body allowing access to all internal equipment and wiring; mount to solid walls or internal studs.

3. Provide baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or COR.
 4. Provide integral and adjustable EIA/ECA 310 standard predrilled rack mounting rails to allow front panel equipment mounting and access.
 5. After equipment, doors and panels are installed, snap-in-place chrome trim strip covers all front panel screw fasteners.
 6. Provide full-length vertical piano hinge to allow entire front portion of cabinet to “swing out” from wall for access to installed equipment, wires and cable; maintain minimum OSHA Safety clearances and NFPA operational functions.
 7. Provide an OEM’s fully assembled unit enclosure.
 8. Equip these cabinets same as equipment cabinets, except mount UPS on floor below cabinet with AC power connection in conduit to AC service panel.
 9. Technical Characteristics:
 - a. Overall Height: Maximum 1,218 mm (48 inches).
 - b. Overall Depth: Maximum 558 mm (22 inches).
 - c. Overall Width: Maximum 610 mm (24 inches).
 - d. Front Panel Horizontal: Maximum width 483 mm (19 inches).
 - e. Capacity: Maximum 180 kilograms (400 pounds).
 - f. Lockable:
 - 1) Tubular lock with 7-pin security.
 - 2) Key cabinets alike.
 - 3) Police SMS access card system.
- F. Stand Alone Open Equipment Rack:
1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel with manufacturer's standard paint finish, in a color to be selected by COR with concurrence from facility's FMS Service Chief.
 2. Floor-mount as directed by COR with concurrence from facility's FMS Service Chief.
 3. Equip rack same as equipment cabinet, except mount UPS with additional support for weight and AC power connection in conduit to AC service panel.
 4. Provide an OEM fully assembled unit.
 5. Technical Characteristics:
 - a. Overall Height: Maximum 2,180 mm (85-7/8 inches).
 - b. Overall Depth: Maximum 650 mm (25-1/2 inches).
 - c. Overall Width: Maximum 535 mm (21-1/16 inches).
 - d. Front Panel Opening: 483 mm (19 inches), EIA/ECA 310 horizontal width.
 - e. Hole Spacing: Per EIA/ECA 310.
 - f. Load Capacity: Maximum 680.4 kg (1,500 lbs).
 - g. Certifications:
 - 1) EIA/ECA: 310-E.
 - 2) NRTL (i.e. UL): OEM specific.
- G. Wire Management Equipment:
1. Provide an orderly horizontal and vertical interface between outside and inside wires and cables, distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide an uniform connection media for system fire-retardant wires and cables and other subsystems.
 2. Interface to each cable tray, duct, wireway, or conduit used in the system.
 3. Interconnection or distribution wires and cables must enter system at top (or from a wireway in the floor) via overhead protection system and be uniformly routed down either or both sides at same time, of the frames side protection system, then laterally for termination on rear of each respective terminating assembly.
 4. Custom configure to meet 30 percent fill system design and user needs.
- H. Vertical Cable Managers:

1. Use same make, style and size of vertical cable manager on rack/frame or in between racks/frames when more than one cable manager is used on a rack/frame or group of racks/frames.
 2. Match color and cover style of racks/frames and cable managers.
- I. Horizontal Cable Managers:
1. Use same make and style of cable manager on rack/frame or racks/frames, when more than one horizontal cable manager is used on a rack/frame or group of racks/frames.
 2. Match color of racks/frames and cable managers.
- J. Telecommunication Room (TR): In hostile TR locations identified on drawings, where it has been determined (by COR or Facility Chief Engineer) that proper TR climate or external signal radiation cannot be maintained or controlled, provide a minimum of two individual and properly sized self-contained climate controlled equipment cabinet enclosures; one designated for voice, and one designated for data, and one additional cabinet designated for analog RF service.
- K. Provide installation hardware when enclosures or racks are attached to structural floor.
- L. Provide noise filters and surge protectors for each equipment interface cabinet, switch equipment cabinet, control console, and local and remote active equipment locations to ensure protection from input primary AC power surges so as a consequence noise glitches are not induced into low voltage data circuits.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate cabinet installation such that doors fully close and lock, with active and passive equipment installed and connected.
- B. Verify equipment dimensions and brackets allow mounting with cabinet doors closed. Front door or rear door of any cabinet that does not close and lock may result in immediate cancellation of inspections or tests.

3.2 INSTALLATION

- A. Equipment Cabinets:
1. Install cabinets in a manner that complies with OEM instructions, requirements of this specification, and in a manner which does not constitute a safety hazard.
 2. Provide weatherproof equipment installed outdoors or install in NEMA 3S rated enclosures with hinged doors and locks with two keys.
 3. Install equipment indoors in NEMA 4 rated metal cabinets with hinged doors and locks with two keys.
- B. Grounding:
1. Bond equipment, including identified Government furnished equipment, to ground so total ground resistance measures maximum 0.1 Ohm.
 - a. Install lightning arrestors and grounding in accordance with NFPA.
 - b. Install gas protection devices at nearest point of entrance in buildings where protection is required and on same circuits as MDF in telephone switch room.
 - c. Do not use AC neutral, including in power panel or receptacle outlet, for system control, subcarrier or audio reference ground.
 - d. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted.
 2. Connect each equipment grounding terminal to a separate mounting hole on equipment mounting rail, to right as one looks at it from rear, with a minimum #12 AWG stranded copper wire with protective green jacket.
 3. Extend common ground bus of minimum #10 AWG solid copper wire throughout each equipment cabinet and bond to TGB. Provide a separate isolated ground connection from

each equipment cabinet ground bus to system ground. Do not tie equipment ground buses together.

4. Bond equipment to cabinet bus with copper braid equivalent to #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.
5. Bond cable shields to cabinet ground bus with minimum #12 AWG stranded copper wire at only one end of cable run. Insulate cable shields from each other, faceplates, equipment racks, consoles, enclosures or cabinets, except at system common ground point. Bond coaxial and audio cables only at source; in all cases, keep cable shield ground connections to a minimum.

C. Equipment Assembly:

1. Cabinets:
 - a. Install and adjust cabinet/frame accessories to position, including thermal management accessories, vertical cable managers, vertical power managers and equipment-mounting rails, using manufacturer's installation instructions prior to buying or placing cabinet for attachment to building and before installing any rack-mount equipment into cabinet. Shelves, horizontal cable managers and filler panels (rack-mount accessories), if used, may be installed after cabinet is placed.
 - b. When used in a multi-cabinet bay, attach cabinets side-by-side using buying kits according to manufacturer's instructions.
 - c. Attach overhead ladder rack or cable tray to ceiling or top of cabinet. Maintain minimum 75 mm (3 inches) clearance between top of cabinet and bottom of ladder rack/cable tray. Position ladder rack/cable tray so that it does not interfere with hot air exhaust through cabinet's top panel. Use radius drops where cable enters or exits ladder rack/cable tray.
 - d. Install ladder rack with side stringers facing rack or cabinet so that ladder forms an inverted U-shape and so that welds between stringers (sides) and cross members (middle) face away from cables.
 - e. Secure ladder rack to tops of equipment racks or cabinets using manufacturer's recommended supports and appropriate hardware.
 - f. Attach bonding conductor sized per TIA-607-B between telecommunications grounding busbar and cabinet. Attach bonding conductor to cabinet using a ground terminal block according to manufacturer's installation instructions.
 - g. Provide bonding conductor and other hardware required to make connections between cabinet and telecommunications grounding busbar.
 - h. Install rack mounted equipment normally requiring adjustment or observation so operational adjustments can be conveniently made.
 - i. Mount heavy equipment with rack slides or rails to allow servicing from front of enclosure. Provide support in addition to front panel mounting screws for heavy equipment.
 - j. Provide with cable slack to permit servicing by removal of installed equipment from front of enclosure.
 - k. Install color-matched blank panel spacer 44 mm (1.75 inches) high between each piece of active and passive equipment to ensure adequate air circulation for efficient equipment cooling and air ventilation.
 - l. Provide quiet fans and non-disposable air filters at each console or cabinet.
 - m. Install enclosures and racks plumb and square, permanently attached to building structure and held in place.
 - n. Provide 381 mm (15 inches) of front vertical space opening for additional equipment.
 - o. Install equipment located indoors in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.

- p. Cables must enter equipment racks or enclosures in such a manner to allow doors or access panels to open and close without disturbing or damaging cables.
 - q. Mount distribution hardware in a manner that allows access to connections for testing and provides room for doors or access panels to open and close without disturbing the cables.
2. Racks:
- a. Assemble racks according to manufacturer's instructions.
 - b. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching rack to floor.
 - c. Attach assembled racks to floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through raised floor tile and be secured in structural floor below.
 - d. Bond racks to telecommunications grounding busbar using appropriate hardware provided by contractor.
 - e. Ladder rack may be attached to top of rack to deliver cables to rack. Do not drill rack to attach; use appropriate hardware from rack manufacturer.
 - f. Provide radius drops to guide cable where cable exits or enters side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field.
 - g. Evenly distribute equipment load on rack. Place large and heavy equipment towards bottom of rack. Secure equipment to rack with equipment mounting screws.
3. Vertical Cable Managers:
- a. Provide vertical managers so number of cables in each manager does not exceed OEM fill capacity.
 - b. Attach vertical cable managers to side of rack/frame using manufacturer's installation instructions and hardware.
 - c. Attach vertical cable manager to both racks/frames when a single vertical cable manager is used between two racks/frames.
 - d. Dress cables through openings in between T-shaped guides on manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
 - e. Attach doors to cable manager in closed position after cabling is complete.
4. Horizontal Cable Managers:
- a. Attach horizontal cable managers to rack/frame with minimum four screws according to manufacturer's installation instructions. Center each cable manager within allocated rack-mount space (RMU).
 - b. Provide horizontal managers located so number of cables each manager supports is less than cable manager's cable fill capacity.
 - c. Dress cables through openings in between T-shaped guides on cable manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
 - d. Attach covers to cable manager in closed position after cabling is complete.
- D. Labeling: Permanently label each enclosure in accordance with TIA-606-B using laser printers handwritten labels are not acceptable.
- 1. Equipment: Label system equipment with contrasting plastic laminate or bakelite material on face of unit corresponding to its source.
 - 2. Conduit, Cable Duct, and/or Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 m (10 feet), identifying system.

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SECTION 27 15 00

COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA here-in-after referred to as the "facility".

1.2 RELATED WORK

- A. Wiring devices: Section 26 27 26, WIRING DEVICES.
- B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. 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.
- D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- E. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.
- F. Voice communication switching and routing equipment: Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT.

1.3 SUBMITTALS

- A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide:
 - 1. Pictorial layout drawing of each main computer room showing termination cabinets, each distribution cabinet and rack, as each is expected to be installed and configured.
 - 2. List of test equipment as per 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Certifications:
 - 1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of contract maintenance are authorized representatives of OEM. Include individual's legal name and address and OEM warranty credentials in the certification.
 - 2. Pre-acceptance Certification: Submit in accordance with test procedures.
 - 3. Test system cables and certify to COR before proof of performance testing can be conducted. Identify each cable as labeled on as-installed drawings.
 - 4. Provide current and qualified test equipment OEM training certificates and product OEM installation certification for contractor installation, maintenance, and supervisory personnel.
- C. Closeout Submittal: Provide document from OEM certifying that each item of equipment installed conforms to OEM published specifications.

1.4 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Provide complete system including “punch down” and cross-connector blocks voice and data distribution sub-systems, and associated hardware including telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, “patch” cables, “break out” devices and equipment cabinets, interface cabinets, and radio relay equipment rack.
- B. Industry Standards:
 - 1. Cable distribution systems provided under this section are connected to systems identified as critical care performing life support functions.
 - 2. Conform to National and Local Life Safety Codes (whichever are more stringent), NFPA, NEC, this section, Joint Commission Life Safety Accreditation requirements, and OEM recommendations, instructions, and guidelines.
 - 3. Provide supplies and materials listed by a nationally recognized testing laboratory where such standards are established for supplies, materials or equipment.
 - 4. Refer to industry standards and minimum requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and guidelines listed.
 - 5. Active and passive equipment required by system design and approved technical submittal; must conform to each UL standard in effect for equipment, when technical submittal was reviewed and approved by Government or date when COR accepted system equipment to be replaced. Where a UL standard is in existence for equipment to be used in completion of this contract, equipment must bear approved NRTL label.
 - 6.
- C. System Performance: Provide complete system to meet or exceed TIA Category 5E 6 or on a case by case basis Category 6A for specialized powered systems’ requirements.
- D. Provide continuous inter- and/or intra-facility voice, data, and analog service.
 - 1. Provide voice and data cable distribution system based on a physical “Star” topology.
 - 2. Provide separate cable distribution system for emergency, safety and protection systems (i.e. emergency bypass phones; police emergency voice communications from parking lots and stairwells personal protection, duress alarms and annunciation systems; etc.)
 - 3. Contact SMCS 005OP2H3 (202-462-5310) for specific technical assistance and approvals.
- E. Specific Subsystem Requirements: Provide products necessary for a complete and functional voice, data, analog and videotele communications cabling system, including backbone cabling system, patch panels and cross-connections, horizontal cabling systems, jacks, faceplates, and patch cords.
- F. Coordinate size and type of conduit, pathways and firestopping for maximum 40 percent cable fill with subcontractors.
- G. Terminate all interconnecting twisted pair, fiber-optic or coaxial cables on patch panels or punch blocks. Terminate unused or spare conductors and fiber strands. Do not leave unused or spare twisted pair wire, fiber-optic or coaxial cable unterminated, unconnected, loose or unsecured.
- H. Color code distribution wiring to conform to ANSI/TIA 606-B and construction documents, whichever is more stringent. Label all equipment, conduit, enclosures, jacks, and cables on record drawings, to facilitate installation and maintenance.
- I. In addition to requirements in Section 27 05 11, REQUIREMENTS FOR COMMUNICATION INSTALLATIONS, provide stainless steel faceplates with plastic covers over labels.

2.2 EQUIPMENT AND MATERIALS

- A. Where system connects to an existing or future voice (telephone) system, refer to Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT for specific voice (telephone) equipment and system operational performance standards.

Communications Structured Cabling

- B. Cable Systems - Twisted Pair, Fiber optic, Coaxial and Analog:
1. General:
 - a. Provide cable (i.e. backbone, outside plant, and horizontal cabling) conforming to accepted industry standards with regards to size, color code, and insulation.
 - b. Some areas can be considered "plenum". Comply with all codes pertaining to plenum environments. It is contractor's responsibility to review the VA's cable requirements with COR and OI&T Service prior to installation to confirm type of environment present at each location.
 - c. Provide proper test equipment to confirm that cable pairs meet each OEM's standard transmission requirements, and ensure cable carries data transmissions at required speeds, frequencies, and fully loaded bandwidth.
 2. Telecommunications Rooms (TR):
 - a. In TR's served with UTP and STP fiber optic, coaxial and analog backbone cables, terminate UTP and STP cable on RJ-45, 8-pin connectors of separate 48-port modular patch panels, 110A or equivalent type punch down blocks that are dedicated to voice and data applications.
 - b. Provide 24 port fiber optic modular patch panels with "LC" or OEM specified couplers dedicated for voice, data and FMS applications.
 - c. Provide connecting cables required to extend backbone cables (i.e. patch cords, twenty-five pair, etc.), to ensure complete and operational distribution systems.
 - d. In TR's, which are only served by a UTP and STP backbone cable, terminate cable on separate modular connecting devices, Type 110A punch down blocks (or equivalent), dedicated to data applications.
 3. Backbone Copper Cables:
 - a. Riser Cable:
 - 1) Provide communication riser cables listed in NEC Table 800, 154(a) for the purpose and suited for electrical connection to a communication network.
 - 2) Provide STP or Unshielded Twisted Pair (UTP), minimum 24 American Wire Gauge (AWG) solid, thermoplastic insulated conductors for communication (analog RF coaxial cable is not to be provided in riser systems) riser cables with a thermoplastic outer jacket.
 - 3) Label and test complete riser cabling system.
 4. Horizontal Cable: Installed from TCO jack to the TR patch panel.
 - a. Tested to ANSI/TIA-568-C.2 Category 5E 6 6A requirements including NEXT, ELFEXT (Pair-to-Pair and Power Sum), Insertion Loss (attenuation), Return Loss, and Delay Skew.
 - b. Minimum Transmission Parameters: 500 MHz.
 - c. Provide four pair 0.205 mm² (24 AWG) cable
 - d. Terminate all four pairs on same port at patch panel in TR.
 - e. Terminate all four pairs on same jack, at work area Telecommunication Outlets (TCO):
 - 1) Jacks: Minimum three eight-pin RJ-45 ANSI/TIA-568-C.2 Category 6 Type jacks at TCO.
 - a) Top Port: RJ-45 jack compatible with RJ-11 plug for voice.
 - b) Bottom Two Ports: Unkeyed RJ-45 jacks for data.
 5. Patient Bedside Prefabricated Units (PBPU):
 - a. Provide stainless steel face plate approved for use by PBPU OEM and COR.
 6. Fiber Optics Backbone Cable:
 - a. Provide 50/125 micron OM4 multi-mode cable, containing at minimum 18 strands of fiber, unless otherwise specified.
 - b. Provide loose tube cable, which separates individual fibers from the environment, or indoor/outdoor cables, for outdoor runs or any area that includes an outdoor run.
 - c. Provide tight buffered fiber cable or indoor/outdoor cables for indoor runs.

- d. Terminate multimode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 ft.) cable loop at each end.
 - e. Provide single mode fiber optic cable 8.3 mm containing at minimum 12 strands of fiber, unless otherwise specified. Terminate single mode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 feet) cable loop at each end to allow for future movement.
 - f. Install fiber optic cables in TR's, Voice (Telephone) Switch Room, and Main Computer Room, in rack mounted fiber optic patch panels. Provide female LC couplers in appropriate panel for termination of each strand.
 - g. Test all fiber optic strands' cable transmission performance in accordance with TIA standards. Measure attenuation in accordance with fiber optic test procedures TIA-455-C ('-61', or -53). Provide written results to COR for review and approval.
- C. Cross-Connect Systems (CCS):
1. Copper Cables: Provide copper CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
 2. Maximum DC Resistance per Cable Pair: 28.6 Ohms per 305 m (1,000 feet).
 3. Fiber Optic Cables:
 - a. Provide fiber CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
 - b. Install fiber optic cable slack in protective enclosures.
- D. Telecommunication Room (TR):
1. Terminate backbone and horizontal, copper, fiber optic, coaxial and analog cables on appropriate cross-connection systems (CCS) containing patch panels, punch blocks, and breakout devices provided in enclosures and tested, regardless of installation method, mounting, termination, or cross-connecting used. Provide cable management system as a part of each CCS.
 2. Coordinate location in TR with FMS equipment (i.e. fire alarm, nurse call, code blue, video, public address, radio entertainment, intercom, and radio paging equipment).
- E. Coaxial and Analog Cables: Bond equipment to ground per TIA standards, such that all grounding systems comply with all applicable National, Regional, and Local Building and Electrical codes.
1. Provide current arrester for each copper or coaxial cable that enters from outside of a building regardless if cable is installed underground or aerial.
 2. Provide a gas surge protector/module and bond to earth ground.
- F. Main Cross-connection Subsystem (MCCS): MCCS is common point of distribution for inter- and intra-building copper and fiber optic backbone system cables, and connections to the voice (telephone) and data cable systems.
- G. Voice (or Telephone) Cable Cross-Connection Subsystem:
1. Provide Insulation Displacement Connection (IDC) hardware.
 2. Provide the following for each Category 5E (or on a case by case basis Category 6 for specialized powered systems technically accepted by SMCS 005OP2H3, (202) 461-5310, OI&T and FMS Services and COR) Cabling System termination; cross-connection wires, RJ-45 patch cord connector to RJ-45 patch cord connector , hybrid modular cord to IDC patch cord connector.
 - a. Provide terminations to be accessible without need for disassembly of IDC wafer. Provide IDC wafers removable from their mounts to facilitate testing on either side of connector.
 - b. Provide removable designation strips or labels to allow for inspection of terminations.
 - c. Provide cable management system as a part of IDC.

3. Provide IDC connectors capable of re-terminations, without damage, a minimum of 200 IDC insertions or withdrawals on either side of connector panel.
 4. Install using only non-impact terminating tool having both a tactile and an audible feedback to indicate proper termination.
 5. Provide inputs from PBX, FTS, Local Voice (Telephone) System, or diverse routed voice distribution systems on left side of IDC (110A blocks with RJ45 connections are acceptable alternates to IDC) of MCCS.
 6. Provide system outputs from MCCS to voice backbone cable distribution system on the right side of same IDC (or 110A blocks) of MCCS.
 7. Do not split pairs within cables between different jacks or connections.
 8. Provide UTP cross connect wire to connect each pair of terminals plus an additional 50 percent spare.
- H. Data Cross-Connection Subsystems:
1. Provide patch panels with modular RJ45 female to 110 connectors for cross-connection of copper data cable terminations and system ground with cable management system.
 2. Provide patch panels conforming to EIA/ECA 310-E dimensions and suitable for mounting in standard equipment racks, with 48 RJ45 jacks aligned in two horizontal rows per panel. Provide RJ45 jacks of modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging jack.
 - a. Provide system inputs from servers, data LAN, bridge, or interface distribution systems on top row of jacks of appropriate patch panel.
 - b. Provide backbone cable connections on bottom row of jacks of same patch panel.
 - c. Provide patch cords for each system pair of connection jacks with modular RJ45 connectors provided on each end to match panel's modular RJ45 female jack's being provided.
- I. Fiber-Optic Cross-Connection Subsystems: Provide rack mounted patch or distribution panels installed inside a lockable cabinet or "breakout enclosure" that accommodate minimum 12 strands multimode fiber and 12 strand single mode fiber - these counts do not include 50 percent spare requirement. Provide cable management system for each panel.
1. Provide panels for minimum 24 female LC connectors, able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to OEM's maximum standard panel size for this type of use. Protect patch panel sides, including front and back, by a cabinet or enclosure.
 2. Provide panels that conform to EIA/ECA 310-E dimensions suitable for installation in standard racks, cabinets, and enclosures. Provide panels for system grounding where armored cables are installed.
 3. Provide patch panels with highest OEM approved density of fiber LC termination's (maximum of 72 each), while maintaining a high level of manageability. Provide proper LC couplers installed for each pair of fiber optic cable LC connectors.
 - a. Provide system inputs from interface equipment or distribution systems on top row of connectors of appropriate patch panel.
 - b. Provide backbone cable connections on bottom row of connectors of same patch panel.
 - c. Provide patch cords for each pair of fiber optic strands with connector to match couplers.
 4. Provide field installable connectors that are pre-polished.
 - a. Terminate every fiber cable with appropriate connector, and test to ensure compliance to specifications and industry standards for fiber optic LC female connector terminated with a fiber optic cable.
 - b. Install a terminating cap for each unused LC connector.
- J. Copper Outside Plant Cable: Minimum of STP or UTP, 22 AWG solid conductors, solid PVC insulation, and filled core (flex gel - waterproof Rural Electric Association (REA) listed PE 39 code) between outer armor or jacket and inner conductors protective lining.

1. Provide copper cable system as a Star Topology.
- K. Horizontal Cabling (HC):
 1. Horizontal cable length to farthest system outlet to be maximum of 90 m (295 ft).
 2. Splitting of pairs within a cable between different jacks is not permitted.
- L. Air Blown Fiber: Alternative fiber optic cable installation method.
 1. Air blown fiber installation process (also referred to as air blown cable, air assisted cable, high pressure air blowing, cable jetting, and referred to as air blown fiber herein) typically uses separate optical fiber cables along with separate flexible protective microducts installed where optical fiber cables can be blown in using specific equipment, trained installation personnel and practices.
 2. Indoor Microducts:
 - a. Provide empty bundled microducts comprising an inner layer of microducts optimized for air blown fiber system and an outer jacket layer of plenum riser rated material with product identification and sequential length marking on outer layer at minimum one-meter (three feet) intervals.
 - b. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.
 - c. Size each microduct for 50 percent unoccupied microducts after initial fiber bundle installation.
 - d. Furnish microducts that maintain minimum bend radius of 20 times cable diameter.
 - e. Provide quantity of plugs or end-caps so all unoccupied microducts are plugged on both ends per manufacturer's specifications. Provide plugs or end-caps that can be easily installed or removed from duct connectors as needed over the lifetime of the installation.
 3. Outside Microducts:
 - a. Provide outdoor-rated bundled microducts consisting of a number of empty microducts comprising an inner layer of microducts optimized for air blown fiber system and covered by a rated jacketing material with product identification and sequential length marking on outer layer at one-meter (three feet) minimum intervals.
 - b. Provide microducts with rodent protection at direct buried applications.
 - c. Protect outdoor-rated bundled microducts either by utilizing a moisture barrier and an outer jacket outerlayer of jacketed, galvanized steel armored (underground), direct buried, or outdoor tray or rack locations UV resistant for aerial, outdoor rack or tray applications jacketed, galvanized steel armored for aerial, outdoor rack or tray locations or by utilizing an HDPE jacket (with optional steel-tape wrapped between outer jacket and inner microducts) that has been treated with rodent deterrent.
 - d. Water-blocking must be accomplished by utilizing a moisture barrier within the bundled microduct assembly or by utilizing water-blocked fiber cable.
 - e. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.
 - f. For future capacity, size each microduct provided for 50 percent unoccupied microducts after initial fiber bundle installation.
 - g. Furnish microducts to maintain minimum bend radius twenty times cable diameter.
 - h. Provide quantity of plugs or end-caps so unoccupied microducts are plugged on both ends per manufacturer's specifications, to prevent ingress of contaminants including water.
 4. Microduct Couplers: Provide plastic-bodied pneumatic connector to join microducts of same size.
 - a. Provide straight connectors constructed of a transparent plastic material permitting a visual verification of fiber population.

- b. Provide tee connectors with additional port allowing for gas-blocking in internal/external situations, or provide gas-blocking couplers as needed to protect and isolate classified areas from non-classified areas or provide close-down connectors if needed for midspan assisted blows in long runs
- 5. Microduct Distribution Units: Provide NEMA-rated enclosure, suited for site environmental conditions provided for microduct distribution, routing, and termination.
 - a. Provide unit capable of wall mounting to provide proper geometry for distribution wherever several microducts enter same location or where microduct type transitions take place.
 - b. Size based on number of microducts to enter unit.
- 6. Outdoor Enclosure/Splice Case: Provide outdoor NEMA-rated enclosure, or splice case suitable for site environmental conditions of outside plant microduct distribution and routing.
 - a. Splice Cases: Water-tight, and air-tight re-enterable splice cases that do not require re-entry kits.
 - b. Material: Stainless steel.
 - c. Select enclosure/splice case hardware to meet site conditions.
 - 1) Provide NEMA-4 and 4X enclosures or splice cases in areas where hosing and splashing environmental conditions exist.
 - 2) Provide NEMA-6 and 6P enclosures splice cases in areas where temporary or long term flooded environmental conditions exist.
- 7. Fiber Termination Units: Provide at locations where fiber is to be terminated.
 - a. Provide for strain relief of incoming microducts.
 - b. Provide connector panels and connector couplings adequate to accommodate the number of fibers to be terminated.
 - c. Incorporate radius control mechanisms to limit bending of fibers to manufacturer's recommended minimum or 76 mm (3 inches), whichever is larger.
 - d. Where rack-mount fiber termination hardware is required, provide wall-mount microduct distribution unit near rack and provide individual microducts to route and connect fiber bundle passing through microduct distribution units to fiber termination hardware.
 - e. Provide LC connectors mounted on a coupler panel that snaps into patch panel housing assembly.
- 8. Fiber Bundles or Cables:
 - a. Provide fiber bundles or cables designed and manufactured to facilitate:
 - 1) Rapid installation of fiber using air blown fiber installation process without risk or damage to fibers.
 - 2) Re-installation without degradation of the optical specifications and performance of fiber.
 - 3) Transition points from indoor to outdoor environments without splices.
 - b. Provide jacketed optical fibers manufactured so that the jacketed fiber strands meet GR409 and meet either UL 1666 for riser rated cables or UL 910 for plenum rated cables and are specific to the purpose of being blown throughout the bundled microduct system.
 - c. Provide fiber designed to be stripped and terminated with standard tools.
 - d. Provide fiber designed to be terminated with standard fiber optic connectors.
 - e. Provide maximum 72 strands of fiber to be blown within each microduct; if fiber counts higher than 72 strands are required, provide microcore fiber with counts to 432 strands in larger size microducts.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

- A. Telecommunication Outlet:
 - 1. TCO consists of minimum one voice (telephone) RJ45 jack and two data RJ45 jacks, and one single mode fiber optic, and one multimode fiber optic jacks mounted in a separate steel outlet box 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches) minimum

with a labeled stainless steel faceplate. Where shown on drawings, provide a second steel outlet box minimum 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches), with a labeled faceplate, adjacent to first box to ensure system connections and expandability requirements are met.

2. Provide RJ-45/11 compatible female type voice (telephone) multi-pin connections. Provide RJ-45 female type data multi-pin connections. Provide LC stainless steel ferrule female type fiber optic connectors.
3. Provide wall outlet with a stainless steel face plate and sufficient ports to fit voice (telephone) multi-pin jack, data multi-pin jacks, fiber optic jacks, analog jacks and plastic covers for labels when mounted on outlet box provided (minimum 100mm (4 inches) x 100mm (4 inches) for single and 100mm (4 inches) x 200mm (8 inches) for dual outlet box applications. Install stainless steel face plate, for prefabricated bedside patient unit installations.

B. Backbone Distribution Cables:

1. Meet TIA transmission performance requirements of Voice Grade Category 6.
2. Provide cable listed for environments where it is installed.
3. Technical Characteristics:
 - a. Length: As required, in minimum 1 kilometer (3,000 ft.) reels.
 - b. Size:
 - 1) Minimum 0.326 mm² (22 AWG) outside plant installation.
 - 2) Minimum 0.205 mm² (24 AWG) interior installations.
 - c. Color Coding: American Telephone and Telegraph Company Standard; Bell System Practices Outside Plant Construction and Maintenance Section G50.607.3, Issue 2 February, 1959.
 - d. Minimum Bend Radius: 10X cable outside diameter.
 - e. Impedance: 120 Ohms + 15 percent.
 - f. DC Resistance: Maximum 8.00 ohms/100 m
 - g. Shield Coverage: As required by drawing notes single shield tape design.
 - h. Maximum attenuation for 100m at 20° C:

Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
.772	2.2	-	-	-
1	2.6	2.0	2.0	2.1
4	5.6	4.1	3.8	3.8
8	8.5	5.8	5.3	5.3
10	9.7	6.5	6.0	5.9
16	13.1	8.2	7.6	7.5
20		9.3	8.5	8.4
25		10.4	9.5	9.4
31.25		11.7	10.7	10.5
62.5		17.0	15.4	15.0
100		22.0	19.8	19.1

Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
200			29.0	27.6
250			32.8	31.1
300				34.3
400				40.1
500				45.3

4. Data Multi-Conductor:
- a. Unshielded F/UTP cable with solid conductors.
 - b. Able to handle the power and voltage used over the distance required.
 - c. Meets TIA transmission performance requirements of Category 6.
 - d. Technical Characteristics:
 - 1) 0.205 mm² (24 AWG) - 0.326 mm² (22 AWG) cable
 - 2) Working Shield: 350 V.
 - 3) Bend Radius: 10 times cable outside diameter.
 - 4) Impedance: 100 Ohms + 15%, BAL.
 - 5) Bandwidth: 500 MHz.
 - 6) DC Resistance: Maximum 9.38 Ohms/100m (328 ft.) at 20 degrees C.
 - 7) Maximum Mutual Capacitance: 5.6 nF per 100 m (328 ft.).
 - 8) Shield Coverage:
 - a) Overall Outside (if OEM specified): 100 percent.
 - b) Individual Pairs (if OEM specified): 100 percent.
 - 9) Maximum attenuation for 100m (328 ft.) at 20° C:

Frequency (MHz)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1	2.0	2.0	2.1
4	4.1	3.8	3.8
8	5.8	5.3	5.3
10	6.5	6.0	5.9
16	8.2	7.6	7.5
20	9.3	8.5	8.4
25	10.4	9.5	9.4
31.25	11.7	10.7	10.5
62.5	17.0	15.4	15.0
100	22.0	19.8	19.1
200		29.0	27.6
250		32.8	31.1

Frequency (MHz)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
300			34.3
400			40.1
500			45.3

5. Fiber Optic:
- a. Multimode Fiber:
 - 1) Provide OM4 Type general purpose multimode fiber optic cable installed in conduit for system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
 - 2) Technical Characteristics:
 - a) Bend Radius: Minimum 152 mm (6 inches); outer jacket as required.
 - b) Fiber Diameter: 50 microns.
 - c) Cladding: 125 microns.
 - d) Attenuation:
 - 1) 850 nanometer: Maximum 4.0 dB per kilometer.
 - 2) 1,300 nanometer: Maximum 2.0 dB per kilometer.
 - e) Bandwidth:
 - 3) 850 nanometer: Minimum 160 MHz.
 - 4) 1,300 nanometer: Minimum 500 MHz.
 - f) Connectors: Stainless steel.
 - b. Single mode Fiber:
 - 1) Provide OS1 Type general purpose single mode fiber optic cable installed in conduit for all system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
 - 2) Technical Characteristics:
 - a) Bend Radius: Minimum 100 mm (4 inches).
 - b) Outer Jacket: PVC.
 - c) Fiber Diameter: 8.7 microns.
 - d) Cladding: 125 microns.
 - e) Attenuation at 850 nanometer: 1.0 dBm per kilometer.
 - f) Connectors: Ceramic.

- C. Outlet Connection Cables:
- 1. Voice (Telephone):
 - a. Provide a connection cable for each TCO voice (telephone) jack in system with 10 percent spares able to connect voice (telephone) connection cable from voice (telephone) instrument to TCO voice (telephone) jack. Do not provide voice (telephone) instruments or equipment.
 - b. Technical Characteristics:
 - 1) Length: Minimum 1.8 m (6 feet).
 - 2) Cable: Voice Grade.
 - 3) Connector: RJ-11/45 compatible male on each end.
 - 4) Size: Minimum 24 AWG.
 - 5) Color Coding: Required, telephone industry standard.
 - 2. Data:
 - a. Provide a connection cable for each TCO data jack in system with 10 percent spares to connect a data instrument to TCO data jack. Do not provide data terminals/equipment.
 - b. Technical Characteristics:

- 1) Length: Minimum 1.8 m (6 feet).
 - 2) Cable: Data grade Category 5E or on a case-by-case basis Category 6 for specialized powered systems accepted by SMCS 005OP2H3 (202) 461-5310, IT and FMS Services and COR.
 - 3) Connector: RJ-45 male on each end.
 - 4) Color Coding: Required, data industry standard.
 - 5) Size: Minimum 24 AWG.
3. Fiber Optic:
- a. Provide a connection cable for each TCO fiber optic connector in system with 10 percent spares. Provide data connection cable to connect a fiber optic instrument to TCO fiber optic jack. Do not provide fiber optic instruments/equipment.
 - b. Technical Characteristics:
 - 1) Length: Minimum 1.8 m (6 feet).
 - 2) Cable: Flexible single conductor with jacket.
 - 3) Connector: LC male on each end.
 - 4) Size: To fit OM1 single mode or OM4 multimode cable.
- D. System Connectors:
1. Modular (RJ-45/11 and RJ-45): Provide voice and high speed data transmission applications type modular plugs compatible with voice (telephone) instruments, computer terminals, and other type devices requiring linking through modular telecommunications outlet to the system compatible with UTP F/UTP cables.
 - a. Technical Characteristics:
 - 1) Number of Pins:
 - a) RJ-45: Eight.
 - b) RJ-11/45: Compatible with RJ-45.
 - 2) Dielectric: Surge.
 - 3) Voltage: Minimum 1,000V RMS, 60 Hz at one minute.
 - 4) Current: 2.2A RMS at 30 minutes or 7.0A RMS at 5.0 seconds.
 - 5) Leakage: Maximum 100 μ A.
 - 6) Connections:
 - a) Initial contact resistance: Maximum 20 milli-Ohms.
 - b) Insulation displacement: Maximum 10 milli-Ohms.
 - c) Interface: Must interface with modular jacks from a variety of OEMs. RJ-11/45 plugs provide connection when used in RJ-45 jacks.
 - d) Durability: Minimum 200 insertions/withdrawals.
- E. Fiber Optic Terminators:
1. Pre-polished crimp on type that has proper ferrule to terminate fiber optic cable.
 2. Technical Characteristics:
 - a. Frequency: Light wave.
 - b. Power Blocking: As required.
 - c. Return Loss: 25 dB.
 - d. Connectors: LC.
 - e. Construction: Ceramic.
- F. Conduit and Signal Ducts:
1. Conduit:
 - a. Provide conduit or sleeves for cables penetrating walls, ceilings, floors, interstitial space, fire barriers, etc.
 - b. Minimum Conduit Size: 19 mm (3/4 inch).
 - c. Provide separate conduit and signal ducts for each cable type installation.
 - d. When metal (plastic covered, flexible cable protective armor, etc.) systems are authorized to be provided for use in system, follow installation guidelines and standard specified in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and NEC.

- e. Maximum 40 percent conduit fill for cable installation.
2. Signal Duct, Cable Duct, or Cable Tray: Use existing signal duct, cable duct, and cable tray, when identified and accepted by COR.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install for ease of operation, maintenance, and testing.
- B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.
- C. Cable Systems Installation:
 1. Install system cables in cable duct, cable tray, cable runway, conduit or when specifically approved, flexible NEC Article 800 communications raceway. Confirm drawings show sufficient quantity and size of cable pathways. If flexible communications raceway is used, install in same manner as conduit.
 2. Coordinate outside plant and backbone cables to furnish number of cable pairs for system requirements and obtain approval of COR and IT Service prior to installation.
 3. Bond to ground metallic cable sheaths, etc. (i.e. risers, underground, horizontal, etc.).
 4. Install temporary cable to not present a pedestrian safety hazard and be responsible for all work associated with removal. Temporary cable installations are not required to meet Industry Standards; but, must be reviewed and accepted by COR, IT Service, FMS and SMCS 005OP2H3 (202-461-5310) prior to installation.
- D. Patient Bedside Prefabricated Units (PBPU) Installation:
 1. Under no circumstances, proceed with installing PBPU without written approval of PBPU OEM and specific instructions regarding attachment to or modifying of PBPU.
 2. Maintain UL integrity of each PBPU. If installation violates UL integrity, obtain on site UL re-certification of violated PBPU at the direction of COR.
- E. Labeling:
 1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.
 2. Print lettering of labels with laser printers handwritten labels are not acceptable.
 3. Label both ends of all cables in accordance with industry standard. Provide permanent Labels in contrasting colors and identify according to system "Record Wiring Diagrams".
 4. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and record on "Record Wiring Diagrams".

3.2 FIELD QUALITY CONTROL

- A. Interim Inspection:
 1. Verify that equipment provided adheres to installation requirements of this section. Interim inspection must be conducted by a factory-certified representative and witnessed by COR.
 2. Check each item of installed equipment to ensure appropriate NRTL label.
 3. Verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections comply with TIA standards.
 4. Visually confirm marking of cables, faceplates, patch panel connectors and patch cords.
 5. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

6. Notify COR of the estimated date the contractor expects to be ready for interim inspection, at least 20 working days before requested inspection date, so interim inspection does not affect systems' completion date.
 7. Provide results of interim inspection to COR. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation.
 8. Do not proceed with installation until COR determines if an additional inspection is required. In either case, re-inspection of deficiencies noted during interim inspections must be part of the proof of performance test.
- B. Pretesting:
1. Pretest entire system upon completion of system installation.
 2. Verify during system pretest, utilizing the accepted equipment, that system is fully operational and meets system performance requirements of this section.
 3. Provide COR four copies of recorded system pretest measurements and the written certification that system is ready for formal acceptance test.
- C. Microduct Tests:
1. Furnish COR, obstruction and pressure test data for each microduct installed. Complete pressure and obstruction tests per manufacturer's recommended procedures prior to installing fiber, and ensure 100 percent of all microducts are compliant with manufacturer.
 2. Complete microduct pressure testing before proceeding with end-to-end microduct obstruction testing.
 3. Notify COR at least one week in advance of test date so that Government and design professional may be present to witness testing.
 4. Maintain close contact with chosen and technically-approved OEM and SMCS 005OP2H3 throughout installation, testing and certification process.
- D. Acceptance Test:
1. After system has been pretested and the contractor has submitted pretest results and certification to COR, then schedule an acceptance test date and give COR 30 days' written notice prior to date acceptance test is expected to begin.
 2. Test only in presence of a COR.
 3. Test utilizing approved test equipment to certify proof of performance.
 4. Verify that total system meets the requirements of this section.
 5. Include expected duration of test time, with notification of the acceptance test.
- E. Verification Tests:
1. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test cables after termination and prior to cross-connection.
 2. Multi-mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-14A using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.
 3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.
- F. Performance Testing:
1. Perform Category 5E (or on a case by case basis Category 6 for specialized powered systems accepted by SMCS 005OP2H3, (202) 461-5310, IT and FMS Services and COR) tests in accordance with TIA-568-B.1 and TIA-568-B.2. Include the following tests - wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
 2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with TIA-568-B.3.

- G. Total System Acceptance Test: Perform verification tests for UTP copper cabling systems and multi-mode and single mode fiber optic cabling systems after complete telecommunication distribution system and workstation outlet are installed.

3.3 MAINTENANCE

- A. Accomplish the following minimum requirements during one year warranty period:
1. Respond and correct on-site trouble calls, during standard work week:
 - a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
 - b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.
 2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.
 3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.
 - a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four hour trouble shooting time.
 - b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) are also be deemed as a catastrophic trouble.
 4. Provide COR written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR with sample copies of reports for review and approval at beginning of total system acceptance test.

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SECTION 27 31 00

VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Wiring devices: Section 26 27 26, WIRING DEVICES.
- B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- 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. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.
- F. Voice and data cable distribution system and associated equipment: Section 27 15 00, COMMUNICATIONS STRUCTURED CABLING.

1.3 SUBMITTALS

- A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS submit the following:
 - 1. Bill of Materials.
 - 2. System cabinet and each interface cabinet layout drawing, as each is expected to be installed.
 - 3. Equipment technical literature detailing electrical and technical characteristics of each item of equipment to be furnished.
 - 4. Engineering drawings of system, showing calculated signal levels at system output, each input and output distribution point, proposed telephone outlet values, and signal level at each telephone outlet multi-pin jack.
 - 5. List of test equipment.
- B. Environmental Requirements: Confirm environmental specifications for physical TR areas occupied by system. Identify requirements for initial and expanded system configurations for:
 - 1. Floor loading for batteries and cabinets.
 - 2. Minimum floor space and ceiling heights.

3. Minimum size of doors for equipment passage.
 4. Power Requirements: Provide specific voltage, amperage, phases, and quantities of circuits required.
 5. Air Conditioning, Heating, and Humidity Requirements:
 - a. Identify ambient temperature and relative humidity operating ranges required to prevent equipment damage.
 - b. Air conditioning requirements expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards.
 6. Proposed floor plan, based on expanded system configuration of proposed system for this facility.
 7. Conduit size requirement (between main TR, remote TR, Telephone Equipment Room, MCR and devices).
- C. Submit samples of reports generated by TMS with technical submittal for evaluation of formats and compliance with information field content.
- D. Needs Analysis Report: Provide summary report of the needs analysis conducted per requirements of this section.
- E. Provide current and qualified OEM training certificates and OEM certification for contractor installation, maintenance, and supervisory personnel.
- F. Proof of Performance Test Plan: Provide COR and SMCS 005OP2H3 (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 005OP2H3 (202) 461-5310 and COR included with acceptance test plan.
 3. Submit test equipment certification verifying calibration within six months of system cut-over.
- G. Closeout Submittals:
1. Provide two copies of OEM developed training video presentation for evaluation and approval by COR.
 2. Provide spreadsheet with details of the complete record program in memory for associated station assignments.
 3. Provide a written commitment from system equipment OEM to supply parts and on-site engineering support services for one year warranty service (materials and labor).
 4. Provide OEM certification allowing, OEM or authorized distributor to fully support contract (initial installation, warranty service for warranty period of the contract).
 - a. System equipment OEM's signatory of certified written commitment must be of an individual who has full authority to obligate OEM to this commitment.
 - b. Include names, corporate addresses, and telephone numbers of individuals who have this authority as a part of the commitment.
- H. Maintenance Material Submittals:
1. Furnish 5 percent spare protectors for lightning protection system.
 2. Furnish one spare audio monitor panel.
 3. Furnish on spare electrical supervision panel.
 4. Furnish a complete set of system electronic modules and cards to be used as on-hand operational emergency spare equipment. One each of T-1, DS-**, interface cards etc. is the minimum required or a compliment as directed by OEM. Confer with SMCS 005OP2H3 to determine other spare items required to equip system with emergency repair capabilities that completely adhere to system warranty requirements.

1.4 QUALITY ASSURANCE

- A. Supervision:
1. Provide a full time on-site project manager, effective on issuance of notice to proceed, responsible to coordinate and supervise contractor and sub-contractor personnel in all
Voice Communications Switching and Routing Equipment

phases of installation, training, inspection, cutover, and final acceptance of system. Deliver project manager a complete copy of these specifications to include all amendments prior to start of installation.

2. Coordinate and conduct system data base survey with SMCS 005OP2H3, (202) 461-5310, COR and a member of IT Service identifying all programming of features, classes of service, and equipment installed by type and physical location as specified in this document and all attachments thereto. After survey is completed, turn over a complete list of equipment to COR for approval by SMCS 005OP2H3, (202) 461-5310, prior to start of installation.
3. Ensure that project manager and skilled personnel remain on premise until items on the punch list, developed during inspection, cut-over, and acceptance testing of system are completed, inspected, and accepted by COR.
4. Be responsible for any and all coordination with LEC relative to interface with commercial telephone system; be responsible for removal of voice and data equipment and cabling abandoned by LEC, Government, or other organizations and not retained for exclusive use by Government as a result of this installation.

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

1. System:

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

2. Projected Maximum Growth: Identify projected maximum growth for each item identified in this section. For this purpose, the following definitions are provided to detail system's capability:
 - a. Provide software and hardware required to equip system with items listed under equipped capacity, 30 days prior to system cut-over.

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

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Conform to CFM OI&T Design Guide.
- B. Conform to CFM Electrical Design Manual (EDM-PG18-10, current edition).
- C. Perform the following minimum services designed in accordance with and supported by OEM:
 - 1. Provide continuous inter- and intra-facility voice service.
 - 2. Capacity size and install systems so that loss of connectivity to an external telephone systems, VoIP and facility's LAN/WAN systems does not affect facility's operation in specific designated emergency operating locations and instruments - including the Commission and NFPA 101 listed Analog Emergency By-Pass Phones; Police Emergency Call Equipment (elevator cabs, parking lots, stairwells, Duress Alarms and Locator); Code Blue (One, FAX, Patient Phones).
 - 3. Inter-operate, connect, and function fully with existing Local (Telephone) Exchange Company (LEC) Networks, Federal Telephone Service (FTS) Inter-city Networks, Inter-exchange Carriers, Integrated Services Digital Network (ISDN) and Voice over Internet Protocol (VoIP) at a minimum (NOTE: VoIP Service is not allowed to perform Facility Safety of Life Functions as well as facility's LAN/WAN. Contact SMCS 005OP2H3, (202) 461-5310 for specific technical assistance and approvals.
 - 4. Contain control and switching equipment, voice and digital system, with attendant consoles.
 - 5. Contain voice mail and automatic attendant functions and continuous intra- and inter-facility voice service.
 - 6. Provide universal night answering function from facility designated remote locations.
 - 7. Direct access to trunk level equipment including audio paging, Industry Standard "T" and "DS" carrier protocols, and external protocol converters.
 - 8. Provide connections to "T" and "DS" access/equipment or Customer Service Units (CSU or DTE) used in Federal telephone service and other trunk applications. Provide T-1 equipment required to terminate and make operational the quantity of circuits designated. Connect CSUs to system's emergency battery power supply. Provide system capable of operating in industry standard DS protocol and provide that level of service when required.
 - 9. Contain attendant and operator consoles, video monitors with keyboards, and printers to provide employee directory access from Traffic Management System (TMS). Provide identical capabilities at console positions, video monitors, and keyboards. Provide attendant consoles accepting a mixture of trunk types and extend calls received via these trunks to station users.

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10. Be capable of interfacing and operating with Direct-Incoming-Dial (DID) service to stations as identified herein without affecting intra-facility operation. Provide DID trunk group that must operate as a separate trunk group from other Central Office (CO) trunks.
 11. Contain the designated number of telephone instruments, where each instrument (also referred to as "station") has ability to direct dial other facility telephone stations, public telephone network, tie-lines, and FTS telephone numbers without attendant assistance. Provide dual tone multi-frequency (DTMF) for intra-facility and external-facility calling at each station. The term DTMF, as used herein, is defined as "a dialing or analog operation".
 12. Provide standard digital VoIP telephone instruments at designated TCOs.
 13. Provide at designated TCOs and locations shown on drawings, "Special Hands Free" digital VoIP telephone instruments.
 14. Receive specified telephone signals acquired from LEC and FTS contracted carrier, process and distribute them to designated telephone stations, as determined by Class of Service (CoS).
 15. At a minimum, provide four or TR wall and on either side of each door opening.
 16. Interface and connect telephone multi-pin jack to system via 110 type punch blocks in TR meeting Category 5E level of service.
 17. Perform adjacent channel operation a minimum of local, long distance, and Federal telephone service telephone signals. Install and interface system equipment according to OEM's schematic diagram for adjacent telephone channel operation. Provide testing capability in each equipment cabinet, rack, interface point and test ports that provide access for each telephone channel without need to disconnect distribution cables or equipment. Process each telephone channel as a single channel. Include a means of monitoring complete system with appropriate printout and archiving of each processed and distributed channel.
 18. Design system to minimize cross talk, background processor noise, inter-modulation, and other signal interference. Install and interface system equipment according to OEM head-end schematic diagram for adjacent audio channel operation. Process each audio input channel as a single separate channel and combine into one output channel. Provide, in the telephone switch room, an audio and visual monitoring panel to test each converted audio input and distribution channel and analog channels, transmitted and received signal functions. Electrically supervise system's Alternating Current (AC) power input, stand by batteries and charger, internal Direct Current (DC) power supply primary voltages and currents; and each remote control unit, audio, and analog RF interface unit, from TER. Provide in TER, telephone operator room, MCR, Police Security Service Control Console to check supervisory signals, signal level, audio sound and visual level, and alert personnel to problems.
 19. Point Of Local (Telephone) Exchange Company Demarc: Notify COR if signals at LEC interface point do not meet minimum signal level and quality, detailing the nature of the deficiencies, and expected effect on the telephone signals in the new system.
- D. System Performance:
1. Support and fully operate in the following functional modes:
 - a. ISDN Integrated Services for Digital Networks:
 - 1) Basic Rate Interface (BRI).
 - 2) Primary Rate Interface (PRI).
 - b. Fiber-optic Distributed Data Interface (FDDI).
 2. System Sensitivity: Provided satisfactory service for at least 3,000 feet for all voice locations.
 3. Minimum System Operating Parameters:
 - a. System Speed: Minimum 1.0 giga-Bits (gb) per second.
 - b. Impedance: 600 Ohms, BAL.
 - c. Cross Modulation: -60 deci-Bel (dB).
 - d. Hum Modulation: -55 dB.

- e. System Data Error: Minimum 10 to the -10 Bits per second (Bps).
 - f. Loss: Measured at frame output with reference Zero (0) deci-Bel measured (dBm) at 1,000 Hertz (Hz) applied to frame input:
 - 1) Trunk to station: Maximum 1.5 dB.
 - 2) Station to station: Maximum 3.0 dB.
 - 3) Internal switch crosstalk: -60 dB when a signal of + 10 dBm, 500-2,500 Hz range is applied to primary path.
 - g. Idle channel noise: 25 dB relative noise per channel (rnC) or 3.0 dBm at 0 above (terminated) ground noise, whichever is greater.
 - h. Traffic Grade of Service for Voice: Minimum grade P-01 with an average traffic load of 7.0 One Hundred Call Seconds (CCS) per station per hour.
 - i. Average CCS per Voice Station: CCS capacity maintained at 7.0 CCS and a Time Between Failures (TBF) of 99.99 percent when system is expanded up to the projected maximum growth.
- E. Voice and Audio Standards:
- 1. Input and Output Signal Level: 0.0 dBm at 1 kilo Hertz (kHz) test tone modulation level.
 - 2. Input and Output Impedance: 600 Ohms Balanced (BAL).
 - 3. Input and Output Signals: Terminated on each system unit.
 - 4. Frequency Range: Minimum 50 Hertz (Hz) to 3.0 kHz + 1.0 percent.
 - 5. Signal-to-Noise Ratio: 60 deci-Bell per mili-Volt (dBmV) + 1.0 dBmV.
 - 6. Cross Modulation: -46 dB.
 - 7. Hum Modulation: -55 dB.
 - 8. Isolation (control unit to unit): Minimum 24 dB.
- F. Control Signal Standards:
- 1. Input and Output Signal: 0.0 dBmV + 1.0 dBmV Level.
 - 2. Input and Output Signals Terminated on each system unit.
 - 3. Input and Output Impedance: 600 Ohms, BAL.
 - 4. Channel Bandwidth - Voice: Minimum 50 Hz to 3.0 kHz, + 5.0 percent.
 - 5. S/N Ratio: 60 dBmV + 1.0 dBmV.
- G. Telephone Outlet (TCO):
- 1. Isolation (outlet-outlet): Minimum 24 dB.
 - 2. Impedance: 600 Ohms.
 - 3. Signal Level: 0 dBmV + 0.1 dBmV.
 - 4. System Speed: Minimum 100 mega-Bits (mb) per second.
 - 5. System Data Error: Minimum 10 to the -6 Bits per second.
- H. General Product Requirements:
- 1. Provide current model of standard products of OEM of record. OEM of record to be defined as a commercial business enterprise manufacturing items of equipment and which:
 - a. Maintains a factory production line for equipment submitted.
 - b. Maintains a stock of replacement parts for equipment submitted.
 - c. Maintains engineering drawings, specifications, and operating manuals for equipment submitted.
 - d. Has published and distributed descriptive literature and equipment specifications on equipment submitted at least 30 days prior to the Invitation for Bid.
 - 2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated.
 - 3. Where standards are established for supplies, materials or equipment, furnish supplies, materials and equipment listed by NRTL.
 - 4. Provide equipment labeled with approved seal of NRTL.
 - 5. Provide COR with verification, at time of installation type of cable being provided is recommended and approved by OEM. Provide cabling meeting requirements of NRTL,

- TIA Wiring Standards and requirements of NFPA 70. Coordinate correct protection, cable duct and conduit with subcontractors.
6. Interface with telephone, systems utilizing interfacing methods approved by OEM and Government. Acceptable interfacing method requires not only a physical and mechanical connection, but includes matching of signal, voltage, and processing levels, with regard to signal quality and impedance. Provide separation of Critical Care, Life Safety, and Emergency systems.
 7. Provide solid state active electronic component rated for continuous duty service and complying with FCC standards, for telephone 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, punch blocks, breakout boxes, splice blocks. Terminate unused equipment ports/taps according to OEM's instructions for telephone cable systems without adapters. Terminate unused or spare twisted pair cable, and fiber-optic cable that is unconnected, loose or unsecured.
 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 three days.
 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 Root Mean Squared (RMS) or 42V direct current (DC), except for primary power to power supply circuits.
 13. Color Coded Distribution Wiring: Conform to ANSI/TIA-606-B standard. Clearly and permanently label equipment, cable duct and conduit, enclosures, wiring, terminals, and cables according ANSI/TIA 606-B standard record wiring diagrams, to facilitate installation and maintenance.
 14. Connect primary input power to critical branch of emergency AC power distribution system.
 15. Provide UPS sized for equipment to function and operate normally during input power fluctuations or loss of power for a minimum of four hours.
 16. Provide plug-in connectors to connect equipment.
 17. Utilize barrier terminal screw type connectors, at a minimum for base band cable systems.
 18. Crimp Type Connectors:
 - a. Type installed with a ratchet tool are an acceptable alternative if cable dress, pairs, shielding, grounding, connections and labeling are provided same as barrier terminal strip connectors.
 - b. Tape of any type, wire nuts, or solder type connections will not be permitted.
 19. Provide stainless steel, anodized aluminum faceplates, or UL approved cyclac plastic matching equipment.
 20. Provide noise filters and surge protectors for each equipment (including interface cabinets) control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches.
 - 21.

2.2 EQUIPMENT

A. Equipment Functional Characteristics:

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

B. System Equipment:

Voice Communications Switching and Routing Equipment

1. Self-contained, electronic, digital and VoIP in operation, providing the following minimum functions:
 - a. Intra-facility station-to-station four digit direct dialing to include those telephone instruments equipped with DID features.
 - b. Direct-output-dial (DOD) from any unrestricted telephone instrument to any CO trunk, ISDN, or FTS access lines by dialing a pre-designated access code.
 - c. DOD from any station to tie lines by dialing a pre-designated access code.
 - d. Ability of incoming calls from FTS access lines and tie lines to direct dial system stations without attendant assistance.
 - e. Access to outside lines through operator's console at restricted telephone instruments.
 - f. Access to features, functions, CO trunks, FTS access lines, tie-lines, toll free numbers, and long distance directory assistance from unrestricted telephone instruments.
 - g. Minimum 40 Class-of-Service (COS) restrictions to be applied individually or in combination as dictated by individual telephone number service requirements. Describe number and type of COS restrictions available in submittals.
2. Provide station users with standard feature package listed by this paragraph, and provide ability to restrict any of these features on a station by station basis.
 - a. Line Hunt Capability: Assign sequential and circular line hunting lines to a hunt group submit number of hunt groups available and capacity of each group.
 - b. Consultation Hold: Capability to place an incoming call on hold while making a consulting call, then return to original call.
 - c. Call Transfer: Permit a user to transfer an incoming or outgoing CO trunk, FTS, or tie-line call to another system station without attendant assistance.
 - d. Call Pick-Up: Answer a ringing, but unanswered call, within a pre-designated group of station lines by dialing a feature code or activating a feature button.
 - e. Call Forwarding "Follow Me" Functions: Automatically reroute incoming calls to another selected telephone number. Activate and deactivating this feature from selected telephone instruments at their discretion.
 - f. "Busy and Don't Answer" Functions: Automatically reroute calls to a pre-programmed secondary telephone instrument when a given telephone instrument is busy or does not answer within a prescribed time interval.
 - g. Call Queuing: Telephone instrument encountering a busy trunk, e.g. CO, FTS, Foreign Exchange Service (FX), and tie-lines, can be automatically connected to the trunk when it becomes available.
 - h. Call Back/Ring Back: Call back/ring back is activated at calling instrument initiating call to another internal busy instrument by an access code or feature button. Automatically ring calling instrument when both instruments become idle, and when answered, rings called instrument without preventing calling instrument from originating or receiving other calls.
 - i. Music on Hold: Provide music on hold to system station lines, CO trunks, FTS access lines, and tie-lines when placed on hold. Acceptable music source is digital media player as accepted by SMCS 005OP2H3 and COR. Off air radio or non-royalty sources cannot be used for this function.
 - j. Conferencing: A telephone instrument initiated conference (minimum of three parties) which allows stations to conference any combination of telephone instrument, CO, or FTS calls.
 - k. Automatic Number Identification: A facility where directory number or equipment number of a calling instrument is obtained automatically for use in message accounting.
 - l. Station to Station Call Waiting: Busy telephone instruments allowed to receive a second incoming call from another telephone instrument. Play call waiting tone on busy instrument, upon receiving a second incoming call. The busy instrument has

ability to place initial call on hold and answer second call and alternate between both calls.

- m. Station and System Speed Dialing:
 - 1) System Speed Dialing: Minimum 50 numbers allow designated telephone instruments to originate speed calls to CO, FTS, FX, or tie lines.
 - 2) Station Speed Dialing: Ten numbers per instrument; instrument includes capability of entering, removing, or changing numbers programmed on their Station Speed dialing list.
- n. Call Park: Telephone instrument feature must be provided that allows non-preselected internal instruments to access an attendant initiated feature in response to an internal/external paging situation.
- o. Universal Night Answer Service: Provide a means of night service transfer for answering incoming calls, which would normally be answered at console, from locations other than console. Chimes, with cut-off switches, to announce incoming calls placed at two locations.
- p. Line Load Control: A pre-programmed attendant controlled feature which, when activated from console positions, restricts all but selected stations from accessing FTS and CO trunks during emergency conditions. Activation of line load control must not affect intra-facility communications, e.g., station to station, access to Public Address system, audio-page, etc.
- q. Dual Common Controls: The following are the minimum features required:
 - 1) Provide a redundant common processing unit with automatic transfer capability offering a stored program technology control feature.
 - 2) Either common control is capable of handling the total system traffic load without degradation of service.
 - 3) In event of failure of primary common control automatically switch to redundant unit with no interruption to calls in progress and no loss of program features.
- r. Line Lock Out:
 - 1) In event a telephone instrument handset is not replaced in telephone instrument cradle, after a pre-determined time interval with no dial action lock out that station line, i.e., not tie up system switch equipment.
 - 2) Apply audible tone to locked out station lines.
 - 3) Automatically restore associated station line to full service when a locked-out telephone instrument handset is replaced.
- s. Supervisory Telephone (not Electrical or Electronic) Signaling and Ringing:
 - 1) Provide dual solid state signal generating devices, or equivalent, which produce standard supervisory signaling, i.e., ringing, dial tone, busy tone, etc. A maximum one-third of installed main station line capacity can be affected by failure of any one signal generating device.
 - 2) Provide automatic transfer to alternate signal generating device in event of failure of primary device for dual solid state signal generating devices.
 - 3) Supervisory Signaling and Ringing:
 - a) Provide tones to indicate progress of a call through the exchange, i.e. dial tone - to indicate that switching equipment is ready to receive dial digits and, when required, provide a secondary dial tone for FTS 2000 access; busy tone (60 to 120 interruptions per minute) - to indicate that a busy line or trunk has been encountered; audible ring back tone - to indicate to calling subscriber that the number dialed is being called.
 - b) Provide supervisory signaling and ringing devices capable of operating from emergency DC power source.
- t. Fusing:

- 1) Equip system with fuses to protect total telephone system and individual segments of system so that a problem in one segment can be isolated without damaging the total system.
 - 2) Provide alarm indicating type fuses with their rating designated by numerical or color code on fuse panels that are easily visible.
 - u. Equipment Power Supply:
 - 1) Equip system with a complete on-line power supply consisting of AC surge protection, dual load-sharing rectifierschargers, batteries, and inverter.
 - 2) Capacity of power supply must support system including projected maximum growth and as required in this specification for interfaced equipment.
 - 3) Coordinate with Local Exchange Company (LEC) to determine CO trunk, FTS access line, and other required interface unit power requirements and provide power to interface units so they can continue to function in event of a commercial AC power failure.
 - v. UPS with Battery Back-up or Reserve Battery Power Supply:
 - 1) Provide reserve battery power supply with capacity to supply system for a minimum of four hours including projected maximum growth and interfaced equipment consisting of minimum 24 sealed maintenance-free cells. Dry cell batteries are not acceptable. Include capability of adjustable voltage for float or equalizing batteries.
 - 2) Provide fully redundant system (not including batteries and inverter) with rectifier or charger capacity to support combined load requirements of system at its maximum growth and interfaced equipment.
 - w. Alarms and Trouble Indicators: It is acceptable to combine required electrical and electronic supervision functions in these panels provided supervisory standards are met.
 - 1) Provide and make operational visual and audible alarms, equipped with cut-off switches, indicating AC power failure, rectifier failure, major and minor trouble, temperature/humidity, electrical or electronic supervisory alarms. Provide sensors for remote environmental alarms at attendant console area and one other location. Separate these alarms in addition to major and minor alarms on attendant consoles.
 - 2) Provide small red indicator lamps on alarm panel for each alarm with cut-off switches or one switch for all alarms and distinctive audible alarms. If one cutoff switch is provided for all audible alarms, restore alarms to ready status condition for audible registration of additional alarms.
 - 3) On submittal describe other system alarms that are remote and describe system alarms/indicators of malfunctions that are located on the equipment.
 - x. Provide capability of system to provide four-digit intra-station dialing and desired functions described herein.
 - y. Due to varied trunk group requirements and possible future trunk group requirements, e.g. public address system access, alternate access codes can be proposed. Grouping of similar type trunk group/features, e.g. 5-1 public address system (all call), 5-2 public address system zone 1, etc. is acceptable.
 - z. Provide emergency numbers accessible by system station users. Label numbers on console or a multi-line instrument and at least one other designated location. Provide a distinctive audible and visual signal associated with emergency number to ensure an immediate response to calls. Provide capability of priority answering emergency number and extending the call as situation dictates at console or multi-line instrument. A modified trunk circuit can be used for this purpose.
 - aa. Provide sensitivity for voice service up to 914.4 m (3,000 feet).
3. Voice Mail Requirements:
- a. Requirement is an automated call processing capability. Connect automated attendant to system and configured to answer and route calls received on a
Voice Communications Switching and Routing Equipment

predetermined number of central office trunks. Configure system so that, if called extension is busy or does not answer within a predetermined number of rings, route caller to person's voice mail box. Provide complete voice mail system allowing predetermined number of users to send complete and confidential messages in users' voice and receive complete and confidential messages in senders' own voice 24 hours per day, 7 days per week. Integrate into operation of system and be compatible with local telephone company central office.

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

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

c. Provide voice mail system for 500 mailboxes and 40 hours of storage with growth to 60 hours of storage.

4. Voice Mail Features:

- a. Access to system and its features from any instrument anywhere that provides DTMF signaling.
- b. Ability of those leaving a message to review message and edit message that is being placed in mailbox.
- c. Privacy/Security through use of a password.
- d. Ability to send messages to users on voice mail system in the following manner:
 - 1) To any user on same voice mail system.
 - 2) To more than one user on same voice mail system - an ad hoc distribution list determined by sender at time of message transmission.
 - 3) To a predetermined distribution list.
 - 4) Broadcast to users on same voice mail system.
- e. Verification, with Receipt: Ability of a user to request and receive verification of when a message is played through the use of a touch-tone command. Indicate time and date of when a message is played and place that information in sender's mailbox.
- f. Envelope Information: Ability of a user to request and receive time and date information of when specific messages were left in user's mailbox.
- g. Connects to voice mail system through system extension number or a seven/ten digit telephone number from LEC.
- h. Message "PROMPTS" for every transaction: Provide Messages for "GREETINGS" and "INSTRUCTIONS FOR RECORDING OR EDITING A MESSAGE".
- i. Notify user that messages are in user's mailbox with a message waiting tone, lamp, and display.
- j. Notify user, upon accessing system, of how many messages are in user's mailbox.
- k. Message Response Alternatives:
 - 1) Respond or send a reply to another user on same voice mail system.
 - 2) Route message to another user on same voice mail system.
 - 3) Delete message.
 - 4) Save message.
- l. Ability to fast forward or rewind messages.
- m. Present messages to user on a "FIFO" basis.
- n. User Administration: Provide management information and statistics in the following categories:
- o. Port Usage: Traffic statistics on each access path into system.
- p. Usage of Storage Capacity: Remaining storage capacity at any one time and during peak periods.
- q. Mailbox Usage: Connect time and number of new or saved messages.
- r. User administration terminal to allow for "Class of Service Controls" in the following areas and for the following parameters:

- 1) Initial Authorization:
 - a) Ability to enable a mailbox.
 - b) Record "Owner's" name.
 - c) Set initial Pass Number.
 - 2) Usage Control:
 - a) Length of personal greeting.
 - b) Length of messages received.
 - c) Number of messages.
 - d) Message retention time.
 - 3) Feature Authorizations: Allowed or not.
 - a) Group List Creation.
 - b) Group List Usage.
 - c) Broadcast Messages.
- C. Voice Traffic Management System (TMS):
1. Provide complete and self-contained on-site TMS.
 2. Functions:
 - a. Provide laser printer for reports generated by system and maintenance administration terminal.
 - b. Connect TMS to system emergency battery power supply.
 - c. Screen menus to provide access to each category of reports.
 - d. Traffic Accounting and Management Call Detail Recording (CDR) for Voice Circuits (TMS):
 - 1) Include hardware, software, and interconnections for complete system.
 - 2) Contain a database stored on non-volatile media.
 - 3) Provide line numbers, physical locations of equipment by building and room number, department to which a line is assigned, name of persons assigned to a number, type of equipment, and any comments regarding system features.
 - 4) Support additional input and output (I/O) ports for video monitors or other terminals that allows a passive display of data bases by authorized medical center personnel other than those individuals responsible for data input and conducting studies.
 - 5) Protect data bases with user ID and password.
 - 6) Provide separate voice line reports, on demand and predetermined schedule, for automatic printing. The following reports are required:
 - a) Originating trunk traffic by trunk group, expressed in CCS.
 - b) Terminating trunk traffic by trunk group, expressed in CCS.
 - c) All trunks busy, by trunk group, expressed as blocked call count.
 - d) All equipment busy, i.e., no dial tone and failure to complete cross-office call because of all equipment busy, expressed in blocked call count.
 - e) List of equipment alarms, error tables, trouble logs, history files, etc.
 - e. Measurements for each console:
 - 1) Incoming calls.
 - 2) Calls answered.
 - f. Provide remote video monitors compatible with TMS hardware and software in immediate vicinity of telephone operators for use as an on-line directory lookup system of facility personnel.
 - g. Print reports in English notation that do not require interpretation of abbreviations or codes by the user.
 - h. Provide storage on disk to prevent a purge of stored data. Maintain call record and facility usage data in database for a minimum 30 days with storage capability of accommodating a minimum 5,000 calls per day.

- i. Furnish normal system traffic data to appropriate facility staff within seven days of a facility request. Prepare quarterly and submit, to appropriate facility staff, a comprehensive traffic study, including the required traffic data with the contractor's comments and recommendations.
 - j. Load and maintain directory that includes, name, title, organization, location, extension, and class-of-service.
 - k. Provide cable plant management function with the following minimum requirements:
 - 1) A list of off-premise cable by circuit number, numbers of pairs for each circuit, and circuit definition.
 - 2) Complete cable plant distribution record to identify location (cable pair) on main distribution frame, riser, cable size, cable pair in-use (main cable feeder and station cable), building and room number of termination, and equipment type terminated.
 - 3) Automatically provide the cable number and pair assignments, when service order is entered.
 - l. Provide equipment inventory list containing the following minimum requirements:
 - 1) System cabinets, cards (active and spares), batteries, current and surge protectors, rectifiers, peripheral equipment, i.e. public address etc.
 - 2) Quantity of single and multi-line telephones, speakerphones, dial intercom units, speakers, gongs, loud horns, bells, chimes, recorders, etc.
 - 3) A list of equipment as being used or spare; ordered or received; installed date, warranty date, cost, location, serial number, etc.
 - m. Provide electrical and/or electronic supervisory alarms and faults reports.
- D. Attendant Console:
- 1. Attendant consoles must be compatible with local commercial telephone system:
 - a. Powered from system's emergency battery power supply.
 - b. Load sharing to ensure that all incoming calls are evenly distributed among consoles regardless of traffic load.
 - c. Telephone signal (not electrical or electronic) supervision over all calls connected through console providing indication of:
 - 1) Called party answer (revert back to attendant if no answer).
 - 2) Trunk group busy.
 - 3) Station Recall to Attendant: In event of an incoming call being placed (in a hold status) prior to a station being dialed after a specified time this call must revert to the attendant.
 - d. Call transfer capability by attendant.
 - e. Automatic ring of called station with ring back tone provided to calling party.
 - f. Console designed for operation as far as 304.8 m (1,000 feet) from PBX equipment cabinets serviced by a 0.205 mm² (24 AWG) cable.
 - g. Attendant console must provide:
 - 1) Ability to enter any on-going voice call, regardless of whether call was connected through console, direct-in-dial, or originated as an intra-station call. Apply warning tone when attendant enters an on-going voice call.
 - 2) "Call-splitting" ability that permits attendant to exclude either outside or inside party when handling trunk calls.
 - 3) "Camp-on busy" feature, that permits attendant to place incoming voice calls on hold until called station number, is available. Tone burst to be applied to busy line to alert that a call is waiting.
 - 4) When busy line becomes free, the waiting call is automatically connected. If waiting call is not connected after a pre-determined time, the waiting call reverts to the attendant.
 - 5) Universal Night Answering Service: Provide ability for incoming calls to be answered from a location other than console.

- 6) On-the-ear models attendant headsets, equipped with coiled cord, plug-In case amplifier, and quick disconnect for 10 attendants. Submit type of headsets to be provided.
 - 7) One supervisor plug-in handset with a push-to-talk button and a nine-foot cord.
 - 8) Dual tone multi-frequency dialing for attendant completion of incoming, outgoing, and intra-station calls.
 - h. Automated Attendant Features:
 - 1) Access from any instrument anywhere that provides DTMF signaling.
 - 2) Voice "PROMPTS" for every transaction.
 - 3) Introductory greeting.
 - 4) Ability of caller to enter extension of the person being called and connection to that extension or enter zero for connection to operator.
 - 5) Capability of providing caller with a directory and sub-directories of telephone numbers and ability to enter desired extension at any time while listening to directory.
- E. Cross-Connection System (CCS) Equipment: Breakout, termination connector (or bulkhead), patch panels, and connection assemblies, in addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATION, must include the following:
1. Connector panels made of flat smooth 3 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in cabinet.
 2. Bulkhead equipment connectors mounted on panel to enable cabinet equipment's signal, control, and coaxial cables to be connected through panel.
 3. Each panel color matching cabinet installed.
- F. Voice (or Telephone):
1. 110-type punch blocks certified for Category 6 represent the minimum requirement for voice or telephone, and control wiring instead of patch panels. Category 6 IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS. Secure punch block strips to OEM designed physical anchoring unit located on a wall in Demarc Room, Telephone Equipment Room, and TR. However, console, cabinet, rail, panel, etc. mounting is allowed at OEM recommendation and as accepted by COR. Punch blocks will not be accepted for Class II or 120 VAC power wiring.
 2. Technical Characteristics:
 - a. Number of Horizontal Rows: Minimum 100.
 - b. Number of Terminals per Row: Minimum 4.
 - c. Terminal protector: Required for each used or unused terminal.
 - d. Insulation Splicing: Required between each row of terminals.
- G. Fiber Optic and Analog Audio:
1. Product reference type must be tele wire, PUP-17 with pre-punched chassis mounting holes arranged in two horizontal rows. This panel can be used for fiber optic, audio, control cable, and Class II Low Voltage Wiring installations when provided with proper connectors. This panel will not be permitted for 120 VAC power connections.
 2. Technical Characteristics:
 - a. Height: Minimum two RUs, 89 mm (3.5").
 - b. Width: Minimum 484 mm (19 1/16"), EIA.
 - c. Number of Connections: Minimum 12 pairs.
 - d. Audio Service: Use RCA 6.35 mm (1/4 inch) Phono, XL or Barrier Strips, surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained).
 - e. Control Signal Service: Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained).

- f. Low Voltage Power (Class II): Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted.
 - g. Fiber Optic: "LC" Stainless steel, female.
- H. Mounting Strips and Blocks:
- 1. Barrier Strips:
 - a. Barrier strips are permitted for AC power, data, voice, and control cable or wires that accommodate size and type of audio spade (or fork type) lugs used with insulating and separating strips between terminals for securing separate wires in orderly fashion.
 - b. Provide barrier strips with audio spade lug, which is connected to an individual screw terminal on barrier strip at each cable or wire end.
 - c. Secure barrier strips to console, cabinet, rail, panel, etc. Do not connect 120 VAC power wires to signal barrier strips.
 - 2. Technical Characteristics:
 - a. Terminal Size: Minimum 6-32.
 - b. Terminal Count: Any combination.
 - c. Wire Size: Minimum 20 AWG.
 - d. Voltage Handling: Minimum 100 V.
 - e. Protective Connector Cover: Required for Class II and 120 VAC power connections.
 - 3. Solderless Connectors: Crimp-on insulated lug to fit 6-32 minimum screw terminal. Install fork connector using standard crimp tool.
 - 4. Furnish items for balancing and minimizing interference capable of passing telephone signals in frequency bands selected, in directions specified, with low loss, and high isolation and with minimum delay of specified frequencies and signals. Provide equipment necessary to meet requirements of this section and system performance standards.
- I. Audio Monitor Panel:
- 1. EIA standard panel for mounting in upper portion of 480 mm (19 inches) system equipment cabinet. This unit can be combined in system's Annunciating System and Electrical Supervision Panel, in order to achieve the minimum electrical supervision requirements of system. Refer to system technical data for additional required specifications.
 - 2. Technical Characteristics:
 - a. Monitor Speaker: A permanent magnet, 76 mm (3 inch) minimum diameter, and a monitor volume control.
 - b. Audiometer: Easy to read volume unit (vu) or similar meter with illuminated scale and meter calibrating control.
 - c. Channel Selector Switch: Six positions (Off, 1, 2, 3, 4, and Spare) which connect monitor speaker and VU meter to selected audio channel.
- J. Electrical Supervision Panel:
- 1. Provide electrical supervision panel in system cabinet and Telephone Operator, locations and as designated on drawings compatible with system's Trouble Annunciation Panel and Audio Monitor Panel, to generate electrical and electronic supervising signals to continuously monitor operating condition for system, CSU, telephone, and interconnecting cable trunks. Generate an audible and visual signal when system's supervising system detects system, CSU, or trunk line is malfunctioning.
 - 2. Technical Characteristics:
 - a. Silence Button or Switch: Silence the audible signal; visual signal must continue until supervisory circuit indicates fault is corrected.
 - b. Visual Enunciators: Visually show amplifier and trunk-line unit or supervisory circuit is in fault condition.
- K. Telephone Instruments:

1. Provide telephone instruments equipped with inductive capability to radiate a magnetic field required to activate hearing aid telecoil and to provide personnel, who use hearing aids, access to all telephones within facility.
2. Provide station equipment consisting of standard single line instruments, patient bedside instruments, and multi-line digital electronic telephone instruments with digital display, of latest design.
3. Provide telephone instruments except patient bedside phones, with a flash button (or equivalent feature button) with pre-determined timing feature to initiate consultation hold and other features normally initiated by operation of hook-switch. Flash button must be distinct from hook-switch.
4. Attach laminated faceplate listing most common user features and their appropriate access codes to telephone instruments, except patient bedside phones. Faceplates can be an integral part of instrument housing or be an adhesive backed decal applied over tone pad area of housing at time of telephone set installation.
5. Provide station instruments feature compatible and with transmission characteristics compatible with proposed system.
6. Provide telephone instrument signaling by means of standard adjustable, buzzers, chimes, or electronic tone, unless otherwise specified.
7. Single Line Instruments:
 - a. Single line instruments can be electronic or 2500-type analog phones.
 - b. Single line instruments used must be capable of supporting bridged cabling to allow a single phone number on multiple instruments without using multiple switch ports.
 - c. Single line instruments must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment without using multiple switch ports.
8. Multi-Line Instruments, Digital and Electronic - Features:
 - a. Digital read-out display and with minimum 14 programmable (lines or features) buttons.
 - b. Adjustable electronic tone to announce calls.
 - c. Detect an incoming call to multi-button instrument and provide an audible signal only on designated lines.
 - d. Lights to identify called line and remain illuminated for duration of call.
 - e. Associate telephone intercom systems with these instruments.
 - f. Equipment associated with intercom systems can require special features such as built in microphone and speaker. Provide secretaries with a means of announcing calls to offices with extensions or pickups on system. Identify provision of intercom systems during required data base survey and provide any required intercom systems.
 - g. This equipment must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment. Use of analog switch ports to provide ringing voltage, if required, is acceptable and include these switch ports in equipped capacity.
 - h. Provide hot line telephones between two identified points equipped with two-way automatic ring and cut-off controlled by telephone hook-switch, i.e. when near-end hand set is removed from hook switch, far-end telephone rings until hand set is removed from hook-switch.
 - i. Configure speaker on hands-free telephone stations to be used as both transmitter and receiver to answer or initiate a call. These facilities to normally be used as a hot line between two points.
9. Patient Bedside Instruments - Features:
 - a. Maintenance free, sanitized packet, and capable of supporting table top, side-rail, top bed-rail, or wall mounting. Provide each phone with minimum 15 feet of self-contained line cord.

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

8. Install a triplex outlet with modular jacks and stainless steel face plate for each telephone outlet shown on drawings. Provide appropriate modular jack (single or triplex) with appropriate face plate for each outlet location identified and verified on drawings.
9. Install patient and wall telephone instruments on a single modular jack designed for wall telephone instruments and patient wall or PBPU installations.
10. Install permanent telephone cables in conduit or an enclosed duct system. Obtain acceptance for installation, as determined by Government requirements, without conduit or enclosed duct system in cable tray or mechanically supported and separated from other signal cable systems.
11. Where cables penetrate fire/smoke partitions, firewalls, or floors, coordinate installation of firestopping material of type accepted by COR.
12. Install equipment in accordance with specifications for system as recommended by OEM.
13. Replace ceiling tiles damaged during installation and maintenance service of cable and wire distribution system. Restore immediate areas damaged during system installation and maintenance service.
14. Run all cross connects to established circuits during installation and maintenance service for contract life.
15. Remove, on a daily basis, debris and scrap generated in conduct of work.

C. Rack and Cabinet Equipment Mounting:

1. Install rack mounted equipment on enclosure's equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustments can be conveniently made.
2. Heavy Equipment:
 - a. Install heavy equipment using rack slides or rails allowing servicing from front of enclosure.
 - b. Install additional support to supplement front panel mounting screws for heavy equipment.
3. Install cable slack to permit servicing by removal of equipment from front of enclosure.
4. Install a color matched blank panel (spacer) of 44 mm (1-3/4 inches) high, between each piece of equipment (active or passive) to ensure adequate air circulation maintaining enclosure design for efficient equipment cooling and air ventilation.
5. Provide 380 mm (15 inches) of front vertical space opening for additional equipment. Install color matched blank panels to cover any unused enclosure openings.
6. Connect signal connector, patch, and bulkhead panels (i.e. PA, telephone, control, etc.) so that outputs from each source, device or system component to enter panel at top row of jacks, beginning left to right as viewed from front; these are to be called "inputs". Install connection to load, device or system component to exit panel at bottom row of jacks, beginning left to right as viewed from front; these are to be called "outputs".
7. Mount equipment located indoors installed in metal racks or enclosures with hinged doors so it can be accessible for maintenance without interference to other nearby equipment.
8. Fasten cables to equipment racks or enclosures in a manner that allows doors or access panels to open and close without disturbing or damaging cables.
9. Install distribution hardware allowing access to connections for testing and provide room for doors or access panels to open and close without disturbing cables.

D. Conduit, Cables And Wiring, Cable Tray, Raceways, Signal Ducts, Etc:

1. Conduits installed in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
2. Ensure that Telephone systems (as identified by NEC Section 517) are separated and protected from other systems.

3.2 FIELD QUALITY CONTROL

A. Interim Inspection:

1. Conduct an interim inspection of installed equipment in presence of COR, prior to proof of performance testing. Verify that equipment provided, adheres to installation requirements of this section.
 2. Install 50 percent of system equipment to include system, interface, origination and junction enclosures powered with permanent AC wiring, outlets, conduit and cables, before interim inspection can take place.
 3. Notify COR of estimated date contractor expects to be ready for interim inspection, at least seven working days before requested inspection date.
 4. Furnish results of interim inspection to COR and PM. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation. SMCS 005OP2H3, (202) 461-5310, must be a part of this inspection team.
 5. COR, in conjunction with PE, will determine if an additional inspection is required, or if contractor will be permitted to proceed with the installation. In either case, re-inspection of deficiencies noted during the interim inspections are to be part of the proof of performance test. The interim inspection is not permitted to affect the system's completion date. Include test documents as part of system's record wiring diagrams.
- B. Pretesting: Align and balance system, upon completing installation of the system. Pretest entire system.
- C. Pretesting Procedure: During system pretest, verify (utilizing the accepted spectrum analyzer and test equipment) that system is fully operational and meets the system performance requirements. Measure and record the aural carrier levels of each system telephone, at each of the following points in the system:
1. Local Exchange Company (LEC) inputs.
 2. System inputs and outputs.
 3. TER, MCR and TR amplifiers, channel processor and converter inputs and outputs.
 4. System output S/NR for each telephone.
 5. Signal level at each interface point to distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.
 6. Submit four copies of recorded system pretest measurements along with pretest certification, to COR.
- D. Pretesting Certification: After pretesting system, notify COR that system is ready for proof of performance testing in presence of a SMCS 005OP2H3, (202) 461-5310, and COR, and that it meets requirements stated in construction documents. Submit notification of system readiness no later than twenty working days prior to scheduled Government proof of performance test. Failure of contractor to comply with these pretest requirements, automatically cancels the scheduled acceptance test.
- E. Acceptance Test:
1. After system has been pretested and contractor has submitted pretest results and certification to COR, schedule an acceptance test date and give COR thirty days written notice prior to date acceptance test is expected to begin include expected length (in time) of test. Test in the presence of COR and an OEM certified representative. Test utilizing accepted test equipment to certify proof of performance. Verify that total system meets specified requirements under operating conditions, and complies with listed system performance standards.
 2. Make only those operator adjustments required to show proof of performance. Demonstrate and verify that installed system does comply with operational requirements under operating conditions. Rate system as either acceptable or unacceptable at conclusion of the test. Failure of any part of system, that precludes completion of system testing and cannot be repaired within four hours, terminates the acceptance test of system.

3. Declare entire system unacceptable if repeated failures result in a cumulative time of eight hours to effect repairs and retesting entire system at the convenience of Government.
- F. Acceptance Test Procedure:
1. Mechanical and Physical Inspection:
 - a. COR will tour major areas where system and sub-systems are located, to ensure they are properly installed in place, and are ready for proof of performance acceptance testing. A system inventory including available spare parts must be taken at this time. Verify equipment to ensure appropriate UL certification labels are affixed.
 - b. Review system diagrams, record drawings, equipment manuals, AutoCAD files, intermediate and pretest results.
 - c. Failure of system to meet installation requirements of this specification terminates testing.
 2. Subsystem Operational Test:
 - a. After the mechanical and physical inspection, perform an operational test of each sub-system to verify that equipment is properly connected, interfaced and is operational to meet requirements of this section. If any sub-system is not functionally ready, that sub-system will be declared unacceptable and testing terminated. At this point, contractor is only permitted one hour to correct deficiencies.
 - b. Mutually agree with COR, at this time, to wait one hour or to commence testing of next sub-system.
 - c. Repeated failures of sub-system testing or total system testing, that results in a cumulative time of four hours to effect repairs, is grounds for declaring entire system unacceptable and testing to be terminated. Reschedule retesting at convenience of Government.
 3. Sub-system Performance Test: After operational test of each sub-system, verify that performance requirements and standards are met using test equipment. Verify there are no visible signal distortions, such as intermodulation, beats, etc. appearing on any received or generated telephone with A spectrum analyzer, signal level meter and bit error rate analyzer (BERT).
 4. Total System Test: Commences only after system and sub-systems have been tested and accepted.
 - a. LEC Point of Demarcation: Check system outputs.
 - b. System: Test within 30 days following successful pretesting of system. In addition to compliance with technical characteristics and quantities of equipment specified herein, the final acceptance test provision that 30 continuous days of uninterrupted telephone service, must be completed prior to contractor being deemed in compliance with the contract.
 - 1) For purpose of final acceptance, telephone service is considered interrupted when failure of any contractor provided telephone equipment including batteries, results in an interruption of service. This includes a failure of more than 20 percent of any trunk group, 15 percent of any number group (15 or more stations), operator console, or telephone service to any area determined to be critical by Facility Director. Response time to restore service has bearing upon the term "interrupted service".
 - 2) To facilitate system acceptance test and to allow familiarization and training of government employees, activate system, including operator consoles, stations, and equipment a minimum 30 days prior to acceptance test date. Test installed equipment and circuits prior to acceptance by Government. During this "burn-in" period, de-bug the system. Make system available for in-house communications and demonstrate required features to facility staff.

Government and contractor will make available trunks are available to system during this "burn-in" period for testing.

5. Individual Item Test: COR can select individual items of equipment for detailed proof-of-performance testing to verify items selected meet or exceed minimum requirements of the specification.
 6. Interface Cable Sub-system: Check minimum 75 percent of system outlets and interface points to ensure that system meets performance requirements.
 - a. Each sub-system interface, junction, and connection point or location will be checked.
 - b. Each distribution active and passive item of equipment, signal inputs and outputs must be tested.
 7. Distribution Cable Plant Sub-system: For specific distribution testing instructions refer to Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
- G. Test Conclusion:
1. At conclusion of acceptance test, using the generated punch list (or discrepancy list), Government will reschedule testing on deficiencies and shortages.
 2. If system is declared unacceptable without conditions, retest expenses are borne by the contractor.

3.3 SYSTEM STARTUP

- A. Provide personnel (switch technicians, installers, trainers, project manager, etc.) on premise for seven consecutive days after cutover to clear any malfunctions that develop, to assign/reassign any software features/COS, and conduct any additional training as required.
- B. Connect telephone equipment located in TER to telecommunications grounding busbar.
- C. Provide system ground between system and interfaced systems such as PA system equipment chassis, etc.
- D. Ensure that other dedicated telecommunications systems applications within facility (i.e., pay stations, electro-writing equipment, facsimile etc.) that require space within TER, MCR and TRs, conduits, and cable pair are accommodated. Coordination between applicable parties is necessary to ensure accommodation of these systems.
- E. Verify all portions of system installation conform to local building and fire codes.

3.4 TRAINING

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

3.5 MAINTENANCE

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

Voice Communications Switching and Routing Equipment

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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SECTION 27 51 23

INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies a new and fully operating Intercom (IC) System. The system shall provide a large 7-inch (180 mm) touch screen monitor for clear visitor identification and easy operation control. The system shall be installed at a maximum of 8 door locations and connected to a maximum of 8 inside locations with internal communication between stations. Connection to and integration of CCTV cameras for surveillance capabilities shall be available.
 - 1. The system shall be hard wired and constructed with a Cat 6 communication system for the door stations and for the video locations system.
 - 2. Hearing Assistance: Provide T-Coil connection for hearing aids.
- B. Conform to VAAR 852.236.91 and intent of the construction documents, recognizing that it may be impracticable to detail all items because of variances in manufacturers to achieve indicated intent.

1.2 RELATED WORK

- A. Connection to Electronic Access Control at doors: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.
- B. Door hardware and operation of doors: 08 71 00 DOOR HARDWARE
- C. Conduit and boxes: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- D. Electrical conductors and cables: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.
- E. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- F. Requirements for interfacing with Facility's PHYSICAL ACCESS CONTROL SYSTEM: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

1.3 SUBMITTALS

- A. In addition to requirements of SECTION 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit:
 - 1. Written certification from OEM proposed provider of contract maintenance is an authorized representative of OEM. Include provider's legal name, address, and OEM credentials.
 - 2. Submit names, locations and point of contact for three installations employing proposed OEM IC Systems of comparable size and complexity performing for at least one year after final acceptance by user.
- B. Certifications:
 - 1. Submit documentation that supplier has been an authorized distributor and service organization for OEM for a minimum of three years and is authorized by OEM to pass thru OEM's warranty of installed equipment to Government.
 - 2. Submit certificate of successful completion of OEM's installation and training program for each installing technician of equipment being proposed. Provide current OEM

certifications for installers to be approved by COR before being allowed to commence work on system.

3. Provide current OEM certification documenting maintenance and supervisory personnel are authorized by OEM to service installed equipment during warranty.
4. Furnish copies of applicable national, state and local licenses.

C. Warranty: Submit OEM warranty.

D. Needs Assessment Report: Provide a summary report of the needs assessment meeting conducted with nursing manager of each unit, as required by this section.

E. Maintenance Material Submission:

1. Provide one spare 304 m (1,000 foot) roll of accepted system (not microphone) cable.

1.4 QUALITY ASSURANCE

A. Assign only technicians trained, qualified, and certified by OEM on engineering, installation, operation and testing of system.

B. Provide system firmware from OEM with a proven history of product reliability and sole control over all source code.

1.5 WARRANTY

A. Comply with FAR clause 52.246-21, except that warranty must be as follows:

1. Manufacturer shall warranty their equipment and certified installation for a minimum of two years from date of installation and final acceptance by the Government.
2. Provide, free of charge, product firmware and software upgrades for a period of one year from date of final acceptance by Government for any product feature enhancements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide voice and video communication between wall-mounted intercom stations and desk or wall-mounted master stations.

B. Provide accessories and miscellaneous appurtenances required for a complete and operating communications system and network.

C. Coordinate features and select components to form an integrated IC system. Match components and interconnections for optimum performance of specified functions.

D. Expansion Capability: Increase number of Room Speaker-Microphone stations in future by 25 percent above those indicated without adding any internal or external components or trunk cable conductors.

E. Equipment: Modular type, continuous duty rated.

F. Weather-Resistant Equipment: Listed by a National Recognized Testing Laboratory (NRTL) for operation in wet, damp or outdoor locations.

G. Install IC head end equipment in room 105 and connect doors 100, 101C, 103, 122, 165, and CLCB. Provide zoned, one-way voice & video paging through distributed, wall-mounted units. Interconnect so voice input into IC is by zone from main console at Info Desk in Foyer .

2.2 PERFORMANCE CRITERIA

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, the minimum requirements for each system are:

1. Wired IC systems approved to connect to separate communications system (i.e. SMS, WAN, LAN includes: Telephone, Nurse Call, radio paging, wireless systems) minimum requirements:

Intercommunications and Program Systems

- a. NIST FIPS Pub 140/2.
 - b. UL 60950-1, edition 2.
 2. IEC 62368-1 ed 2: 2014.
 3. Code of Federal Regulations, Title 47, Part 15 (or FCC Part 15) Listed Radio Equipment is not permitted.
- B. Provide system with configuration programming capable of being executed remotely via a remote connection (when specifically accepted by Spectrum Management and COMSEC Services (SMCS 0050P2H3) without any exchange of parts.

2.3 EQUIPMENT ITEMS

- A. Microprocessor-Switched System:
1. Master Station Features:
 2. The Master Station shall accommodate up to 8 Door Stations and 8 Master Stations in a single system.
 3. Provide icon driven One Touch Hands Free operation. Touch the screen to communicate with visitors using the built-in microphone and speaker or use the handset at any time during conversation for privacy.
 4. Operation: From Master Station. Provide the following.
 - a. Room Call: Touch screen icon to call a single sub master station or all sub master stations simultaneously.
 - b. Play: Touch screen icon to play recorded images from door stations.
 - c. Settings: Touch screen icon to program settings and adjustments.
 - d. Security: Touch screen icon to activate the security mode or to change security settings.
 - e. Monitor: Touch screen icon to monitor a door station or sub master station.
 - f. Option: Touch screen icon to activate the connected external device(s).
 5. Available Functions During Monitoring: Provide the following.
 - a. Pan-Tilt-Zoom/Wide camera control.
 - b. When monitoring is started, an image shall be shown in wide mode. Pan & Tilt and adjusting images shall be possible from the Master Station.
 - c. Door release shall be possible from the Master Station.
 - d. Volume control shall be possible from the Master Station.
 - e. Manual recording shall be possible from the Master Station.
 6. Physical Characteristics:
 - a. Power supply: DC 24V (from power supply).
 - b. Current Consumption: 390 mA.
 - c. Communication: Handset - Simultaneous communication.
 - d. Communication: Hands-free - Auto-voice actuation.
 - e. Ambient Temperature 32 degree F to 104 degree F (0 to 40 degrees C).
 - f. Monitor: 7 inches (180 mm) color LCD monitor.
 - g. Mounting: Wall mount.
 - h. Electrical box: 3-gang box
 - i. Material: Flame resistant ABS resin.
 - j. Color: White.
 - k. Dimensions: 5-11/16 inches H x 10-1/16 inches W x 1-7/8 inches D (145 mm by 255 mm by 48 mm).
 - l. Weight: Approx. 1.74 lbs (790 g).
- B. Room Station (Sub Master Station):
1. Provide icon driven One Touch Hands Free operation. Touch the screen to communicate using the built-in microphone and speaker or use the handset at any time during conversation for privacy.
 2. Physical Characteristics:
 - a. Power supply: DC 24V (from power supply).
 - b. Current Consumption: 200 mA.

- c. Communication: Handset - Simultaneous communication.
 - d. Communication: Hands-free - Auto-voice actuation.
 - e. Ambient Temperature: 32 degree F to 104 degrees F (0 to 40 degrees C).
 - f. Monitor: 7 inch color LCD monitor.
 - g. Electrical box: 3-gang box.
 - h. Material: Flame resistant ABS resin.
 - i. Color: White.
 - j. Dimensions: 5-11/16 inches H x 10-1/16 inches W x 1-7/8 inches D (145 mm by 255 mm by 48 mm).
 - k. Weight: Approx. 1.74 lbs (790 g).
- C. Door/Entrance Station:
- 1. The Door Entrance Station shall automatically record images. Recording starts approximately 2 seconds after receiving a call.
 - 2. 170 degree wide angle and 100 degree vertical angle camera to minimize blind spots, ensuring a clear view of the door station area.
 - 3. Zoom for Clarity/ Pantilt for Control:
 - a. Video door stations feature a wide angle camera to observe more activity behind the door. In addition, digital PanTilt and Zoom can focus on an area for greater detail.
 - b. Oversized buttons and intuitive icons allow for quick navigation and control. Conventional push buttons shall not be permitted.
 - c. Equipped with an advanced light adjustment feature to compensate for varying light levels. If a picture is too dark, increase of the brightness level at the door station shall be controlled at the master station.
 - 4. Record Images of Visitors:
 - a. After a call is placed, the Door Entrance Station records 6 images per call to internal memory.
 - b. Provide an SD / SDHC card (not included) as the primary storage location, with which recording frequency increases to 4 pictures per second for up to 10 seconds per call.
 - c. Provide documentation of outside disturbances by manually recording them at any time.
 - 5. Physical Characteristics:
 - a. Operating Temperature: 14 degrees F to 140 degrees F (-10 to 60 degrees C).
 - b. Dimensions:
 - 1) JP-DA 5-1/8 inches x 3-7/8 inches x 1-9/16 inches (131 x 99 x 40 mm).
 - 2) JP-DV 6-13/16 inches x 3-7/8 inches x 1 inch (173 x 98 x 25 mm).
 - 3) JP-DVF 8-1/4 inches x 5-5/16 inches x 7/32 inch (209 x 135 x 5.5 mm).
 - 4) JP-DVF back box 7-3/32 inches x 4-3/8 inches x 1-25/32 inches (180 x 110 x 45 mm)
 - c. Power Supply: DC 24V (from master station).
 - d. Current Consumption: 90 mA.
 - e. Mounting:
 - 1) Surface mount to 2x4 electrical box.
 - 2) Surface mount direct to surface.
 - 3) Flush mount with included back box.
 - f. Weight:
 - 1) 1.3 lbs (550g).
 - 2) Back Box: 0.95 lbs (430g).
- D. Power Supply: PS-2420UL, 24V DC Power supply.
- E. Distribution Adaptor: JP-8Z.
- 1. Power Supply: DC 24V (from power supply)
 - 2. Current Consumption: 90 mA

3. Operating Temperature: 32 degree F to 104 degrees F (0 to 40 degrees C).
4. Mounting: Wall-mount.
5. Weight: Approx. 7.5 oz (210 g).

2.4 HEAD END EQUIPMENT

- A. Provide required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system.
- B. Head end components can be rack mounted or wall mounted in a metal enclosure.
- C. Provide head end equipment in telecommunications room where IC system is installed.
- D. Provide minimum 30 minute battery back-up (or UPS) to system components.

2.5 SYSTEM CABLES

- A. Comply with SECTION 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING for specific installation and testing requirements.
- B. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper; sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
- C. Insulation: Thermoplastic; minimum 0.8 mm (1/32 inch) thick.
- D. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
- E. Minimum Shielding Coverage on Conductors: 60 percent.
- F. Cabling must be riser rated, plenum rated in designated spaces.

2.6 RACEWAYS

- A. Raceways and Boxes: Comply with requirements in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- B. Each open top raceway must be NRTL listed for telecommunications systems and partitioned with metal partitions in order to comply with NEC Parts 517 and 800 to "mechanically separate" telecommunications systems of different service, protect 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.
- C. IC System Cable Infrastructure: EMT and cable tray NRTL classified for suitability and NRTL listed for telecommunications.
- D. Pull boxes must be minimum 63.5 mm (2-1/2 inches) deep and 152.4 mm (6 inches) wide by 152.4 (6 inches) long.

2.7 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. Provide UPS for system to allow normal operation and function (as if there was no AC power failure) in event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.
- B. As an alternative solution, telephone system UPS can be utilized to meet this requirement at head-end location, as long as this function is specifically accepted by telephone contractor and COR.
 1. Do not make any attachments or connection to telephone system until specifically directed to do so, in writing, by COR.
- C. Provide UPS for active system components including:
 1. System Amplifiers.
 2. Microphone Consoles.
 3. System Interface Units.

4. Head End Equipment Racks.
5. Control Consoles.

2.8 FINISHES

- A. Provide finishes for exposed work such as plates, racks, panels, speakers, etc. accepted by design professional, COR and 005OP3B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review and coordinate with telecommunications cabling installer for location of intercom equipment in Telecommunications Rooms.
- B. Verification of Conditions: Before beginning work, verify location, quantity, size and access for the following:
 1. Isolated ground AC power circuits provided for systems.
 2. Pull boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for systems.
 3. System components installed by others.
 4. Overhead supports and rigging hardware installed by others.
- C. Installer must immediately notify COR, general contractor and design professional in writing of any discrepancies.
- D. Needs Assessment:
 1. Provide a one-on-one meeting with nursing manager of each unit affected by installation of system.
 2. Review floor plans and drawings, educate nursing manager on functions of the equipment and gather details specific to individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that affect system programming and training.
 3. Prepare a summary report of the assessment.

3.2 INSTALLATION

- A. General:
 1. Install work plumb and square and in a manner consistent with standard industry practice.
 2. Protect work from dust, paint and moisture as dictated by site conditions. Contractor is responsible for protection of work until final acceptance by Government.
 3. Install equipment according to OEM's recommendations.
 4. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for complete assembly and installation.
 5. Secure equipment firmly in place, including IC stations, speakers, equipment racks, system cables, etc.:
 - a. Supports, mounts, fasteners, attachments and attachment points must support loads with a safety factor of at least 5:1.
 - b. Do not impose weight of equipment on supports provided for other trades or systems.
 - c. Any suspended equipment or associated hardware must be certified by OEM for overhead suspension.
 - d. Contractor is responsible for means and methods in design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
 6. Coordinate cover plates with field conditions. Size and install cover plates to hide joints between back boxes and surrounding wall. Do not allow cable to leave or enter boxes without cover plates installed.
 7. Where cover plates are not fitted with connectors, provide grommets in size and quantity required.

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- B. Equipment Racks:
1. Fill unused equipment mounting spaces with blank panels or vent panels; match color to equipment racks.
 2. Provide security covers for devices not requiring routine operator control.
 3. Provide vent panels and cooling fans as required for operation of equipment within OEM's specified temperature limits.
 - a. Provide adequate ventilation space between equipment for cooling.
 - b. Follow manufacturer's recommendations regarding ventilation space between amplifiers.
 4. Provide insulated connections of raceway to equipment racks.
 5. Provide continuous conduit with no more than 40 percent fill between wire troughs and equipment racks for non-plenum-rated cable.
 6. Ensure each system is mechanically separated from each other in wireway.
- C. Wiring Practice: In addition to requirements in Section 27 10 00, STRUCTURED CABLING, adhere to the following additional practices:
1. Execute wiring in strict adherence to National Electrical Code, applicable local building codes and standard industry practices.
 2. Where raceway and wire way are EMT (conduit), wiring of differing classifications must be run in separate conduit.
 3. Where raceway and wire way are an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share same enclosure must be mechanically partitioned and separated by 102 mm (four inches). Where wiring of differing classifications must cross, they must cross perpendicular to one another.
 4. Do not splice wiring anywhere along entire length of run.
 5. Make sure cables are insulated and shielded from each other and from raceway for entire length of run.
 6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs.
 7. Do not bend wires to less than radius recommended by manufacturer.
 8. Replace entire length of run of any wire or cable that is damaged or abraded during installation. There are no acceptable methods of repairing damaged or abraded wiring.
 9. Do not apply wire pulling lubricants unless specifically recommended by cable OEM.
 10. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
 11. Do not use tape-based or glue-based cable anchors.
 12. Bond shields and drain wires to ground.
 13. Terminate field wiring entering equipment racks as follows:
 - a. Provide service loops at harness break-outs, plates, panels and equipment to allow plates, panels and equipment to be removed for service and inspection.
 - b. Line level and speaker level wiring can be terminated inside equipment rack using specified terminal blocks.
 - c. Provide 15 percent spare terminals inside each rack.
 - d. Microphone level wiring can only be terminated at equipment served.
 - e. If specified terminal blocks are not designed for rack mounting, utilize 3/4 inch plywood or 1/8 inch thick aluminum plates/blank panels as a mounting surface.
 - f. Do not mount terminal blocks on bottom of rack.
 - g. Employ permanent strain relief for any cable with an outside diameter of 1 inch or greater.
 14. Use only balanced audio circuits unless indicated otherwise.
 15. Make connections as follows:
 - a. Use rosin-core solder or mechanical connectors appropriate to application.
 - b. For crimp-type connections, use only crimp tool specified by manufacturer for the application.

- c. Use only insulated spade lugs on screw terminals. Spade lugs must be sized to fit wire gauge; do not exceed two lugs per terminal.
 - d. Twist on wire connectors and electrical tape are not permitted for any application.
- D. Cable Installation: In addition to requirements in Section 27 10 00, STRUCTURED CABLING, comply to the following practices.
- 1. Acceptable means of cable support are cable tray, wire way, and conduit. Hook and loop wrap cable bundles loosely to cable tray with plenum rated Velcro straps. Plastic tie wraps are not permitted as a means to bundle or support cables.
 - 2. Run cables parallel to walls.
 - 3. Do not lay cables on top of luminaires, ceiling tiles, mechanical equipment, or ductwork.
 - 4. Maintain minimum 61 cm (2'-0") clearance from all shielded electrical apparatus.
 - 5. Test cables after the total installation is complete. Document test results. Remedy any cabling problems or defects in order to pass or comply with testing. This includes re-pull of new cable as required.
 - 6. Terminate both ends of cables per industry and OEM's recommendations.
 - 7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until ready to terminate.
 - 8. Cover end of overall jacket with minimum 25.4 mm (1 inch) length of transparent heat-shrink tubing.
 - a. Cut unused insulated conductors minimum 50.8 mm (2 inches) passed heat-shrink, fold back over jacket and secure with cable-tie.
 - b. Cut unused shield/drain wires minimum 50.8 mm (2 inches) passed heat-shrink cover shield/drain wires with heat-shrink tubing extending to overall jacket. Extend tubing 6 mm (1/4 inch) passed end of unused wires, fold back over jacket and secure with cable tie.
 - 9. For each solder-type connection, cover bare wire and solder connection with heat-shrink tubing.
 - 10. Terminate conductors; no cable must contain unterminated elements. Make terminations only at outlets and terminals.
 - 11. Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables cannot be spliced.
 - 12. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
 - 13. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps are not permitted.
 - 14. Cable must not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
 - 15. Separation of Wires: (Refer to Raceway Installation)
 - a. Separate speaker-microphone, line-level, speaker-level, and power wiring runs.
 - b. Install in separate raceways or, where exposed or in same enclosure, separate conductors at minimum 30.5 cm (12 inches) apart for speaker microphones and adjacent parallel power and telephone wiring.
 - c. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- E. System Conduit: Install manufactured conduit sweeps and long radius elbows according to wire and cable OEM instructions.
- F. Labeling:
- 1. Permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
 - 2. Engrave and paint fill receptacle panels using minimum 3.17 mm (1/8 inch) high lettering and contrasting paint.

3. For rack-mounted equipment, use engraved Lamacoid labels with white minimum 3.17 mm (1/8 inch) high lettering on black background. Label front and back of rack-mounted equipment.
 4. Where multiple pieces of equipment reside in same rack group, label each indicating to which room, channel, receptacle location, etc. they correspond.
 5. Permanently label cables at each end, including intra-rack connections. Labels must be covered by same, transparent heat-shrink tubing covering end of overall jacket. Alternatively, provide computer generated labels of type which include a clear protective wrap.
 6. Contractor's name cannot appear more than once on each continuous set of racks. Contractor's name cannot appear on wall plates or portable equipment.
 7. Ensure each piece of OEM supplied equipment has appropriate NRTL labels for the service equipment is performing. Equipment installed not bearing NRTL label will not be permitted. Contractor is responsible to provide listed replacement equipment with approved NRTL label.
- G. Protection during Installation:
1. Protect electronic devices during unpacking and installation by wearing electrostatic discharge (ESD) wrist straps tied to chassis ground.
 2. Wrist straps must meet OSHA requirements for prevention of electrical shock, if technician comes in contact with high voltage.
- H. Cutting and Patching:
1. Keep work area clear of debris and clean area daily at completion of work.
 2. Patch and paint any wall or surface that has been disturbed by execution of this work.
 3. Provide any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete work or to make its parts fit together properly.
 4. Do not damage or endanger fully or partially completed construction of Government or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. Contractor cannot cut or otherwise alter such construction by facility or separate contractor except with written consent of Government or of such separate contractor; such consent cannot be unreasonably withheld. Contractor cannot unreasonably withhold consent to cutting or otherwise altering work, by facility or a separate contractor.
 5. Where coring of in-place concrete is specified or required, including coring indicated under unit prices, location of such coring must be identified in the field and accepted by COR prior to commencement of coring work.
- I. Fireproofing:
1. Fireproof openings where IC cables penetrate fire rated walls, floors and ceilings.
 2. Provide conduit sleeves (if not already provided) for cables that penetrate fire rated walls and floors and ceilings. After cabling installation is complete, install fire proofing material in and around conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal floor and ceiling penetrations.
 3. Use only materials and methods that preserve integrity of fire stopping system and its rating.
- J. Grounding:
1. Provide grounding system per Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
 2. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
 3. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
 4. Install grounding electrodes as specified in Section 27 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
 5. Do not use "3rd or 4th" wire internal electrical system conductors for ground.

6. Do not connect system ground to building's external lightning protection system.
7. Do not "mix grounds" of different systems.

3.3 FIELD QUALITY CONTROL

- A. Assign only technicians trained, qualified, and certified by OEM on engineering, installation, operation, and testing of system.
- B. Performance Testing:
 1. Intermediate Testing:
 - a. After completion of 25 percent of installation of equipment, including one master station, and remote station, and prior to any further work, this portion of system must be pretested, inspected, and certified. Check each item of installed equipment to ensure appropriate NRTL labels are affixed, NFPA, Life Safety, and Joint Commission guidelines are followed, and proper installation practices are followed. Include a full operational test.
 - b. Arrange for inspection and test conducted by a factory-certified representative to be witnessed by Government and SMCS 005OP2H3 at a minimum and COR. An identical inspection can be conducted between 65 and 75 percent of system construction phase, at direction of COR.
 2. Pretesting:
 - a. Upon completing installation of system:
 - 1) Align, balance, and completely pretest entire system under full operating conditions.
 - 2) Verify (utilizing approved test equipment) system is operational and meets performance requirements of this standard.
 - 3) Verify that system functions are operational, and no unwanted aural effects, (e.g. signal distortion, noise pulses, glitches, audio hum, poling noise, etc.) are present. At a minimum, pretest each of the following locations:
 - a) Networked locations.
 - b) System trouble reporting.
 - c) System electrical supervision.
 - d) UPS operation.
 - b. Provide recorded system pretest measurements and written certification that system is ready for formal acceptance test to COR.
 3. Acceptance Test:
 - a. Schedule acceptance test date giving COR 30 days' written notice prior to date acceptance test is expected to begin. System must be tested in the presence of a Government representative and OEM-certified representative. System must be tested utilizing approved test equipment to certify proof of performance and emergency compliance. Test must verify that the total system meets specification requirements. Notification of acceptance test must include expected duration of time of the test.
 4. Acceptance Test Procedure:
 - a. Physical and Mechanical Inspection:
 - 1) Government representative may tour areas where system and sub-systems are completely and properly installed to ensure they are operationally ready for proof of performance testing. Prepare system inventory including available spare parts. Each item of installed equipment must be checked to ensure appropriate NRTL labels are affixed.
 - 2) System diagrams, record drawings, equipment manuals, Auto CAD Disks, intermediate, and pretest results must be inventoried and reviewed.
 - 3) Failure of system to meet installation requirements of this specification can be grounds for terminating all testing.
 - b. Operational Test:
 - 1) Contractor must demonstrate full functionality of system including:

- a) Station to master calls.
 - b) Station to station calls.
 - c) Broadcast calls.
 - d) Location identification of stations at intercom master station.
- c. Test Conclusion: Government will accept results of the test or require additional testing on deficiencies and shortages. Retesting to comply with these specifications must be done at Government's convenience and contractor's expense.

3.4 TRAINING

- A. Provide training of facility-identified staff assigned to units receiving communications by an IC system. Implement training from master console operator's perspective, and likewise, for any person whose specific responsibilities include answering IC calls and dispatching an appropriate response, provide operational training from their perspective. A separate training room may be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of new system.
- B. Provide the following minimum training times and durations:
 - 1. 24 hours prior to facility opening,
 - 2. 24 hours during the standard work week, and
 - 3. 24 hours for supervisors and system administrators.

3.5 MAINTENANCE

- A. Provide Government personnel with ability to contact contractor and OEM for maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time, during warranty period.
- B. Response Time during Warranty Period:
 - 1. COR is contractor's only official reporting and contact official for IC system trouble calls, during the warranty period.
 - 2. A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by COR, Monday through Friday exclusive of Federal holidays.
 - 3. Respond and correct on-site trouble calls, during the standard work week:
 - a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes one IC station, or master IC station to be inoperable.
 - b. An emergency trouble call within four hours of its report.
 - 1) An emergency trouble is considered a trouble which causes a IC sub system or equipment cabinet, to be inoperable at any time.
 - 2) Emergency trouble calls include routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.). COR must notify contractor of this type of trouble call.
 - 4. If an IC component failure cannot be corrected within four hours (exclusive of the standard work time limits), provide alternate IC equipment.
 - 5. Complete installation of alternate equipment/system within sixteen hours after the four hour trouble shooting time and restore operation of effected location to system performance standards.
 - 6. Replace any sub-system or major system that cannot be corrected within one working day, with compatible temporary equipment returning system or sub-system to full operational capability, until repairs are complete.

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SECTION 27 52 23

NURSE CALL AND CODE BLUE SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

- A. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system warranty, training and services for, and incidental to, the complete installation of new and fully operating National Fire Protection Association (NFPA) – Life Safety Code 101.3-2 (a) Labeled and (b) Listed, Emergency Service Nurse-Call and/or Life Safety listed Code Blue Communication System and associated equipment (here-in-after referred to as the System) provided in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting Nurse-Call and/or Code Blue communications signals generated local and remotely as detailed herein.
- B. Work shall be complete, Occupational Safety and Health Administration (OSHA), National Recognized Testing Laboratory (NRTL – i.e. Underwriters Laboratory UL) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 005OP3B) tested, certified and ready for operation.
- C. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- D. The term “provide”, as used herein, shall be defined as: designed, engineered, furnished, installed, certified, tested, and warranty by the Contractor.
- E. Specification Order of Precedence: In the event of a conflict between the text of this document and the Project’s Contract Drawings outlined and/or cited herein; THE TEXT OF THIS DOCUMENT TAKES PRECEDENCE. HOWEVER, NOTHING IN THIS DOCUMENT WILL SUPERSEDE APPLICABLE EMERGENCY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND/OR LOCAL LIFE AND PUBLIC SAFETY CODES. The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document’s EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing and confirmed by VA’s Project Manager (PM), Resident Engineer (RE) and TVE-005OP3B. The VA PM is the only approving authority for other amendments to this document that may be granted, on a case by case basis, in writing with technical concurrences by VA’s PM, RE, TVE-005OP3B and identified Facility Project Personnel.
- F. The Original Equipment Manufacturer (OEM) and Contractor shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this specification before the system is designed, engineered, delivered and provided. The Contractor shall furnish a written statement stating this requirement as a part of the technical submittal that includes each name and certification, including the OEMs. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

1.2 RELATED SECTIONS

- A. 01 33 23 – Shop Drawings, Product Data and Samples.
- B. 07 84 00 – Firestopping.
- C. 6 05 19 – Low – Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- D. 26 41 00 – Facility Lightning Protection.

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- E. 27 05 11 – Requirements for Communications Installations.
- F. 27 05 26 – Grounding and Bonding for Communications Systems.
- G. 27 05 33 – Raceways and Boxes for Communications Systems.
- H. 27 10 00 – CONTROL, COMMUNICATION AND SIGNAL WIRING.
- I. 27 11 00 – TIP Communications Interface and Equipment Rooms Fittings.
- J. 27 15 00 – TIP Communications Horizontal and Vertical Cabling.

1.3 DEFINITION

- A. Provide: Design, engineer, furnish, install, connect complete, test, certify and warranty.
- B. Work: Materials furnished and completely installed.
- C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.
- D. Headquarters (aka VACO) Technical Review, for National and VA Communications and Security, Codes, Frequency Licensing Standards, Guidelines and Compliance:
 - i. Office of Telecommunications
 - ii. Special Communications Team (005OP3B)
 - iii. 1335 East West Highway – 3rd Floor
 - iv. Silver Spring, Maryland 20910,
 - v. (O) 301-734-0350, (F) 301-734-0360
- E. Contractor: Systems Contractor; you; successful bidder.

1.4 REFERENCES

- A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:
 - 1. United States Federal Law:
 - a. Departments of:
 - 1) Commerce, Consolidated Federal Regulations (CFR), Title 15 – Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:
 - a) Chapter II, National Institute of Standards Technology (NIST – formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops – Federal Information Processing Standards Publication (FIPS) 140-2—Security Requirements for Cryptographic Modules.
 - b) Chapter XXIII, National Telecommunications and Information Administration (NTIA – aka 'Red Book') Chapter 7.8 / 9; CFR, Title 47 Federal communications Commission (FCC) Part 15, Radio Frequency Restriction of Use and Compliance in "Safety of Life" Functions & Locations.
 - 2) FCC - Communications Act of 1934, as amended, CFR, Title 47 – Telecommunications, in addition to Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/ Locations (also see CFR, Title 15 – Department of Commerce, Chapter XXIII – NTIA):

- a) Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.
- b) Part 58 – Television Broadcast Service.
- c) Part 90 – Rules and Regulations, Appendix C.
- 3) Health, (Public Law 96-88), CFR, Title 42, Chapter IV Health & Human Services, CFR, Title 46, Subpart 1395(a)(b) JCAHO “a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:”
 - a) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.
- 4) Labor, CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standard:
 - a) Subpart 7 - Definition and requirements (for a NRTL – 15 Laboratory’s, for complete list, contact (http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html) :
 - b. 44-02 – Standard for Thermoset-Insulated Wires and Cables.
 - c. 65 – Standard for Wired Cabinets.
 - d. 83-03 – Standard for Thermoplastic-Insulated Wires and Cables.
 - e. 467-01 – Standard for Electrical Grounding and Bonding Equipment
 - f. 468 – Standard for Grounding and Bonding Equipment.
 - g. 486A-01 – Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - h. 486C-02 – Standard for Splicing Wire Connectors.
- 2. 486D-02 – Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
 - a. 486E-00 – Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
 - b. 493-01 – Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.
 - c. 514B-02 – Standard for Fittings for Cable and Conduit.
 - d. 1069 – Hospital Signaling and Nurse Call Equipment.
 - e. 1449 – Standard for Transient Voltage Surge Suppressors.
 - f. 1479-03 – Standard for Fire Tests of Through-Penetration Fire Stops.
 - g. 1666 – Standard for Wire/Cable Vertical (Riser) Tray Flame Tests.
 - h. 1863 – Standard for Safety, Communications Circuits Accessories.
 - i. 2024 – Standard for Optical Fiber Raceways.
 - j. 60950-1/2 – Information Technology Equipment – Safety.
- 3. Canadian Standards Association (CSA): same tests as for UL.
- 4. Communications Certifications Laboratory (CCL): same tests as for UL.
 - a. Intertek Testing Services NA, Inc. (ITSNA formerly
 - i. Edison Testing Laboratory ETL): same tests as for UL.
 - ii. Subpart 35 – Compliance with NFPA 101 – Life Safety Code.
 - iii. Subpart 36 - Design and construction requirements for exit routes.
 - iv. Subpart 268 - Telecommunications.
 - v. Subpart 305 - Wiring methods, components, and equipment for general use.
 - 2) Department of Transportation, CFR, Title 49 (Public Law 89-670), Part 1, Subpart C – Federal Aviation Administration (FAA):
 - a) Standards AC 110/460-ID & AC 707 / 460-2E – Advisory
 - b) Circulars for Construction of Antenna Towers.
 - c) Forms 7450 and 7460-2 – Antenna Construction Registration.
 - 3) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:
 - a) Office of Telecommunications:
 - 4) Handbook 6100 – Telecommunications.

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- a) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.
- b) Special Communications Proof of Performance Testing,
- 5) VACO Compliance and Life Safety Certification(s).
 - a) Office of Cyber and Information Security (OCIS):
 - b) Handbook 6500 - Information Security Program.
 - c) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
 - d) VA's National Center for Patient Safety – Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
 - e) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
 - f) Office of Construction and Facilities Management (CFM):
 - i. Master Construction Specifications (PG-18-1).
 - ii. Standard Detail and CAD Standards (PG-18-4).
 - iii. Equipment Guide List (PG-18-5).
 - iv. Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.
 - v. Minimum Requirements of A/E Submissions (PG 18-15): Volume B, Major New Facilities, Major Additions; and
 - vi. Major Renovations, Article VI, Paragraph B.
 - vii. Volume C - Minor and NRM Projects, Article III, Paragraph S.
 - viii. Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
 - ix. Mission Critical Facilities Design Manual (Final Draft – 2007).
 - x. Life Safety Protected Design Manual (Final Draft – 2007).
 - xi. Solicitation for Offerors (SFO) for Lease Based Clinics – (05-2009).
- b. Federal Specifications (Fed. Specs.):
 - 1) A-A-59544-00 - Cable and Wire, Electrical (Power, Fixed Installation).
- 5. National Codes:
 - a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.
 - b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
 - 1) 568-B - Commercial Building Telecommunications Wiring Standards:
 - a) B-1 – General Requirements.
 - b) B-2 – Balanced twisted-pair cable systems.
 - c) B-3 - Fiber optic cable systems.
 - 2) 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 3) 606 – Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
 - 4) 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - 5) REC 127-49 – Power Supplies.
 - 6) RS 270 – Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.
 - c. American Society of Mechanical Engineers (ASME):
 - 1) Standard 17.4 – Guide for Emergency Personnel.
 - 2) Standard 17.5 – Elevator & Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).
 - d. American Society of Testing Material (ASTM):

- 1) D2301-04 - Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape.
- e. Building Industries Communications Services Installation (BICSI):
 - 1) All standards for smart building wiring, connections and devices for commercial and medical facilities.
 - 2) Structured Building Cable Topologies. In consort with ANSI/EIA/TIA.
- f. Institute of Electrical and Electronics Engineers (IEEE):
 - 1) SO/TR 21730:2007 - Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
 - 2) 0739-5175/08/©2008 IEEE – Medical Grade – Mission Critical – Wireless Networks.
 - 3) C62.41 – Surge Voltages in Low-Voltage AC Power Circuits.
- g. NFPA:
 - 1) 70 - National Electrical Code (current date of issue) – Articles 517, 645 & 800.
 - 2) 75 - Standard for Protection of Electronic Computer Data-Processing Equipment.
 - 3) 77 – Recommended Practice on Static Electricity.
 - 4) 99 - Healthcare Facilities.
 - 5) 101 - Life Safety Code.
6. State Hospital Code(s).
7. Local Town, City and/or County Codes.
8. Accreditation Organization(s):
 - a. Joint Commission on Accreditation of Hospitals Organization (JCAHO) – Section VI, Part 3a – Operating Features.

1.5 QUALIFICATIONS

- A. The OEM shall have had experience with three (3) or more installations of Nurse Call systems of comparable size and interfacing complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.
- B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.
- C. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.
- D. The Contractor shall display all applicable national, state and local licenses.
- E. The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's Nurse Call and/or Code Blue equipment being proposed.

1.6 CODES AND PERMITS

- A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested, certified and approved by VA and ready for operation on a date directed by the Owner.
- B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.7 SCHEDULING

- A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.
- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS (AKA TECHNICAL SUBMITTALS)

- A. (Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining alternate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein. VA will review and rate each received alternate submittal, which follows this requirement, in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed.)
- B. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.
- C. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.
- D. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-005OP3B) will not review any submittal that does not have this list.
- E. Provide four (4) copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C & D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).
- F. Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists for the: ENR(s) (aka DMARC), TER, TCR, MCR, MCOR, PCR, ECR, Stacked Telecommunications Rooms (STR), Nurses Stations (NS), Head End Room (HER), Head End Cabinet (HEC), Head End Interface Cabinet (HEIC) and approved TCO locations TIP interface distribution layout drawing, as they are to be installed and interconnected to teach other (REFER TO APPENDIX B – SUGGESTED TELECOMMUNICATIONS ONE LINE TOPOLOGY pull-out drawing).
- G. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

- H. Engineering drawings of the System, showing calculated of expected signal levels at the headend input and output, each input and output distribution point, and signal level at each telecommunications outlet.
- I. Surveys Required as a Part of The Technical Submittal:
 - 1. The Contractor shall provide the following System surveys that depict various system features and capacities required in addition to the on-site survey requirements described herein (see Specification Paragraph 2.4.3). Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal Survey requirements), as a minimum:
 - a. Nurse Call Cable System Design Plan:
 - 1) An OEM and contractor designed functioning Nurse Call System cable plan to populate the entire TIP empty conduit/pathway distribution systems provided as a part of Specification 27 11 00 shall be provided as a part of the technical proposal. A specific functioning Nurse Call: cable, interfaces, J-boxes and back boxes shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire Nurse Call cable and accessory requirements and engineer a functioning Nurse Call distribution system and equipment requirement plan of the following paragraph(s), at a minimum:

2) The required Nurse Call and/or Code Blue Equipment Locations:

EQUIPPED ITEM	CAPACITY	GROWTH
Master Stations	2	2
Dome Lights	29	58
Room	28	56
Corridor	8	16
Other		
Patient Stations	28	56
Single	28	56
Dual		
Isolation		
Other		
Emergency Stations		
Bath	28	56
Toilet	29	29
Isolation		
Other		
Staff Stations	4	8
Duty Stations	4	8
Code Blue		
Patient Locations	28	56
Surgical Recovery Locations		

Nurse Call and Code Blue Systems

EQUIPPED ITEM	CAPACITY	GROWTH
Medical Recovery Locations		
ICU Locations		
SICU		
MICU		
CCU		
Other		
Emergency Room Locations		
Other		
Supervisory Locations		
Nurse Stations	1	2
On-Call Rooms		
Other		
Remote Locations		
Telephone Operator's Room		
Police Control Room		
Other		
Radio Paging Access (when pre-approved by TVE-005OP3B)		
Audio Paging Access (when pre-approved by TVE-005OP3B)		
Wireless Access (when pre-approved by TVE-005OP3B)		
Maintenance/Programming Console		
Location(s)		
Central Control Cabinet/Equipment	1	2
Location	Elec Room	
Power Supply(s)	1	2
UPS(s)	1	2

- 3) The required Nurse Call and/or Code Blue Cable Plant/Connections:
- 4) The Contractor shall clearly and fully indicate this category for each item identified herein as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

EQUIPPED ITEM	CAPACITY	GROWTH
Central Control Cabinet/Equipment	1	2
Location		

Nurse Call and Code Blue Systems

EQUIPPED ITEM	CAPACITY	GROWTH
Power Supply(s)	1	2
UPS(s)	1	2
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified in Paragraph 1.8.H.1.a.2)		
Remote Locations		
Telephone Operator Room		
Police Control Room		
Other		
Maintenance/Program Console		
Location(s)		
Other		
LAN (Local Facility) Access/Equipment/Location (when pre-approved by TVE-005OP3B)		
Wireless Access/Equipment/Location (when pre-approved by TVE-005OP3B)		
PA Access/Equipment/Location (when pre-approved by TVE-005OP3B)		
Other		

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

- A. Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
- B. The floorplans shall be marked in pen to include the following:
 - 1. Each device specific locations with UL labels affixed.
 - 2. Conduit locations.
 - 3. Each interface and equipment specific location.
 - 4. Head-end equipment and specific location.
 - 5. Wiring diagram.
 - 6. Labeling and administration documentation.
 - 7. Warranty certificate.
 - 8. System test results.

1.10 WARRANTIES / GUARANTY

- A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

- B. The Contractor shall agree to grantee the system according to the guidelines outlined in Article 4 herein.

1.11 USE OF THE SITE

- A. Use of the site shall be at the GC's direction.
- B. Coordinate with the GC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the GC and their sub-contractors.
- D. Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Store products in original containers.
- C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.
- D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSE-OUT

- A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.
- B. Before the project closeout date, the Contractor shall submit:
 - 1. OEM Equipment Warranty Certificates.
 - 2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
 - 3. Project record documents.
 - 4. Instruction manuals and software that is a part of the system.
 - 5. System Guaranty Certificate.
- C. Contractor shall submit written notice that:
 - 1. Contract Documents have been reviewed.
 - 2. Project has been inspected for compliance with contract.
 - 3. Work has been completed in accordance with the contract.

PART 2 - PRODUCTS / FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

- A. Furnish and install a complete and fully functional and operable Nurse Call System for each location shown on the contract drawings and TCOs WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.
- B. The specific location for each Nurse Call: Central Control Cabinet is Electrical room Power Supply is Electrical room Electrical Supervisor Panel is Reception UPS is Electrical room, Master Station is Reception Duty Station is Reception, (list locations here AND indicate like locations on the contract drawings).
- C. Coordinate features and select interface components to form an integrated Nurse Call system. Match components and interconnections between the systems for optimum performance of specified functions.

- D. Expansion Capability: The Nurse Call equipment interfaces and cables shall be able to increase number of enunciation points in the future by a minimum of 50 percent (%) above those indicated without adding any internal or external components or main trunk cable conductors.
- E. Equipment: Active electronic type shall use solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied between 110 to 130 VAC, 60 Hz supplied from the Facility's Emergency Electrical Power System.
- F. Meet all FCC requirements regarding equipment listing, low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from within and outside the building structure.
- G. Weather/Water Proof Equipment: Listed and labeled by an OSHA certified NRTL (i.e. UL) for duty outdoors or in damp locations.

2.2 SYSTEM DESCRIPTION

- A. Furnish and install a complete and fully functional and operable Nurse Call and/or Code Blue System WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.
- B. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. 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 with regard to 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.
- C. The System Contractor shall connect the System ensuring that all NFPA and 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. VA shall arrange for the interconnection between the Patient Bed Service Walls Systems with the appropriate responsible parties.
- D. System hardware shall consist of a standalone (separate) nurse call Code Blue patient communications network comprised of nurse consoles, control stations, staff and duty stations, room and corridor dome lights, pillow speakers/call cords, pull cord and/or emergency push button stations, wiring. And, other options such as, pocket page interfaces, computer interfaces, printer interfaces, wireless / telephone network interfaces, and nurse locating system interface (when specifically approved first by TVE 005OP3B) and as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse call Code Blue patient communications network. It is not acceptable to utilize the telephone cable system for the control and distribution of nurse call (code Blue) signals and equipment.
- E. System firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two (2) years from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved first by TVE 005OP3B).
- F. The Nurse Call Head End Equipment shall be located in Power Room. The Nurse Call / Code Blue System may interface the PA system when specifically approved by VA Headquarters TVE 005OP3B during the project approval process prior to contract bidding.

- G. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Self contained or on board system program memory shall be non-volatile and protected from erasure from power outages for a minimum of 12 hours.
- H. Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT and Monitor) 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.
- I. The System is defined as Critical Service and the Code Blue functions is defined as Life Safety/Support by NFPA (re Part 1.1.A) and so evaluated by JCAHCO. Therefore, the system shall have a minimum of two (2) additional remote enunciation points in order to satisfy NFPA's Life Safety Code 101 (the typical secondary locations are Telephone Operators Room, MAS ER Desk, Boiler Plant, etc; AND the primary location is required to be in the SCC Room
1. These two (2) additional remote locations shall be fully manned:
 - a. 24/7/365 for certified Hospital.
 - b. As long as other identified VA Medical / Servicing Facilities are open for servicing patients.
 - c. At a minimum, Code Blue Functions shall be provided in all Recovery (Medical and Surgical) Rooms, Intensive Care Units (ICU), Cardiac Care Units (CCU), Step Down Room, Life Support / Monitoring Rooms, Oncology / Radiology Procedure Rooms, Dialysis Areas.
 - d. The minimum remote enunciation locations shall be:
 - 1) The Telephone / PBX Operator Room.
 - 2) The Police Control / Operations Room.
 - 3) Other location(s) that is specifically approved by VA Headquarters TVE - 005OP3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
 2. In addition to the two (2) remote locations afore described, the following locations are the minimum required for additional Nurse Call /Code Blue Annunciation:
 - a. "On Call" Rooms.
 - b. Each Nurse Master Station.
 - c. Each Staff Station.
 - d. Each Duty Station.
 3. The MAXIMUM enunciation time period from placement of the Code Blue Call to enunciation at each remote locations is 10 seconds; and, 15 seconds to the subsequent enunciating media stations (i.e. PA, Radio Paging, Emergency Telephone or Radio Backup, etc.).
- J. Each Code Blue System shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. dome light bulbs each light will be considered supervised if they use any one or a combination of (UL) approved electrical supervision alternates, as identified in UL-1069, 1992 revision, wires, contact switch connections, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the nurse control station and all remote locations.
- K. When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Public Address, radio raging, wireless systems, etc) the connection point shall meet the following minimum requirements for each hard wired / wireless connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS TVE - 005OP3B AND SPECTRUM MANAGEMENT - 005OP2B – hereinafter referred to as SM - 005OP2B):
1. UL 60950-1/2.
 2. FIPS 142.

3. FCC Part 15 Listed Radio Equipment restriction compliance approved by SM – 005OP2B.
 - L. All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with connectors specified by the OEM.
 - M. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cyclac plastic for the areas where provided.
 - N. Noise filters and surge protectors shall be provided for each equipment interface cabinet, headend 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.
 - O. Plug-in connectors shall be provided to connect all equipment, except coaxial cables. Coaxial cable distribution points shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall 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.
 - P. Audio Level Processing: The control equipment shall 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 acceptable 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 shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified on the contract drawings. The Contractor shall provide: a spare set of telephone paging modules as recommended by the OEM (as a minimum provide one spare module for each installed module); one spare audio power amplifier, one spare audio mixer, one spare audio volume limiter and/or compressor, and one spare audio automatic gain adjusting device, and minimum RF equipment recommended by the OEM.
 - Q. 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 shall be as indicated on the drawings.
 - R. System Performance:
 1. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the Facility's Nurse Call and/or Code Blue System voice and data service as follows:
 - a. Shall be compliant with and not degrade the operating parameters of the Public Switched Telephone Network (PSTN) and the Federal Telecommunications System (FTS) at each PSTN and FTS interface (if attachment is permitted by TVE 005OP3B), interconnection and TCO terminating locations detailed on the contract drawings.
 - b. The System shall provide the following minimum operational functions:
 - 1) Code Blue calls shall be cancelable at the calling station only. The nurse call master station (s) that a managing Code Blue functions shall not have the ability to cancel Code Blue calls.
 - 2) Each Code Blue system shall be able to receive audio calls from all bedside stations simultaneously.
 - 3) Calls placed from any Code Blue station shall generate Code Blue emergency type audible and visual signals at each associated nurse control

- and duty station, respective dome lights and all local and remote annunciator panels. Calls placed from a bedside station shall generate emergency type visual signals at the bedside station and associated dome light(s) in addition to the previous stated stations and panels.
- 4) Activating the silencing device at any location, while a Code Blue call or system fault is occurring shall mute the audible signals at the alarm location.
 - a) The audible alarm shall regenerate at the end of the selected time-out period until the call or fault is corrected.
 - b) The visual signals shall continue until the call is canceled and/or a fault is corrected. When the fault is corrected, all signals generated by the fault shall automatically cease, returning the System to a standby status.
 - c) Audible signals shall be regenerated in any local or remote annunciator panel that is in the silence mode, in the event an additional Code Blue call is placed in any Code Blue system.
 - d) The additional Code Blue call shall also generate visual signals at all annunciators to identify the location of the call.
 2. Each System Nurse Call location shall generate a minimum of distinct calls:
 - a. Routine: single flashing dome lights & master station color and audio tone.
 - b. Staff Assist: rapid flashing dome lights & master station color and audio tone.
 - c. Emergency: Red flashing dome lights & master station color and audio tone.
 - d. Code Blue (if equipped): Blue flashing dome lights and master station color and audio tone.
 - e. Each generated call shall be cancelable at ONLY the originating location,
 - f. Staff Locator: Green Flashing dome lights & master station color and audio tone.

2.3 MANUFACTURERS

- A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM manufacturer of record. An OEM of record shall 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, specifications, and operating manuals for the items submitted, and
 3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
- B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA 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 specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.
- C. Equipment Standards and Testing:
 1. The System has been defined herein as connected to systems identified as Critical Service performing various Emergency and Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
 2. All supplies and materials shall be listed, labeled or certified by UL or a NRTL where such standards have been established for the supplies, materials or equipment.
 3. The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in

existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards. The placement of the UL Seal shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

2.4 PRODUCTS

A. General.

1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment.
2. Contractor Furnished Equipment List (CFEs):

a. The Contractor is required to provide a list of the CFE equipment to be furnished. The quantity, make and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system as described herein and with the OEM's concurrence applied to the list(s), in writing.

Item	Quantity	Unit
1.	As required	Interface Panel(s)
1.a	As required	Electrical Supervision Trouble Enunciator
1.a.1	As required	Equipment Back Box(s)
1.b	As required	Telephone
1.c	As required	Public Address
1.d	As required	Radio Paging / Equipment
1.e	As required	Wireless / Equipment
1.f	As required	Radio Pager / Equipment
1.g	As required	Wireless / Equipment
1.f	As required	Personal Communicator / Equipment
2.	As required	Lightning Arrestor
3.	As required	Head End Equipment/Locations
3.a	As required	Cabinet(s)
3.a.1	As required	AC Power Conditioner & Filter
3.a.2	As required	AC Power Strip
3.a.3	As required	UPS
3.a.4	As required	Interconnecting Wire/Cables
3.a.5	As required	Wire / Cable Connector(s)
3.a.6	As required	Wire / Cable Terminator(s)
3.b	As required	Wire Management System
3.b	As required	Head End Function(s)
3.b.1	As required	H7 Interface
3.b.2	As required	Nurse Locator
3.b.3	As required	Staff Locator
4.	As required	Master Station(s)
4.a	As required	Nurse Locator
4.b	As required	Staff Locator

- B. NS Room(s): Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

- C. TER, SCC, PCR, STR, HER Rooms and Equipment:

- D. Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.
- E. Telecommunications Room(s) (TR):
1. Locate the Nurse Call and/or Code Blue floor distribution equipment as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.
 2. Head-End Equipment:
 - a. Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system. Head-end components may be rack mounted or wall mounted in an enclosed metal enclosure.
 - b. Provide the head end equipment in the closest Telecommunications Room where the System is installed.
 - c. Provide the System UPS inside the cabinet or in a separate cabinet adjacent to the head end cabinet that shall maintain a minimum of 30 minute battery back-up to all system components.
 - d. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions. See Paragraph 2.5.E for the Cabinet's minimum internal items that are in addition to the installed System equipment.
 - e. Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet) containing the following minimum items:
 - 1) 36" (28RU) internal rack space, welded steel construction, minimum 20" usable depth, adjustable front mounting rails.
 - 2) Install the following products in rack provided by same manufacturer or as specified:
 - a) Security screws w/ nylon isolation bushings.
 - b) Textured blank panels.
 - c) Custom mounts for components without rack mount kits.
 - d) Security covers.
 - e) Internal system ground copper buss (may be substituted with a bare #0 AWG copper wire or equivalent size copper mesh strip connected to ONLY THE FACILITY'S SIGNAL GROUNDING SYSTEM.
 - f) Power Sequencer- rack-mounted power conditioner and (provide as-needed) delayed sequencer(s) with (2) unswitched outlets each and contact closure control inputs. Connect the conditioner to one of the dual duplex outlets.
 - g) Two (2) each 120VAC @ 20A dual duplex outlets, connected via conduit to the nearest Electrical Service Panel that is supplied by the Facility's Essential Electrical System.
 - h) One (1) each 120VAC @ 15A Power Distribution Strip(s). Connect each strip to the unstitched outlet on the power conditioner.
 3. HL7 Interface:
 - a. The system may support downloading and updating of patient data from the hospital admission system (or other database) via the HL7 standard. The data only has to travel one way, i.e. from the admission system to the nurse-call system.
 - b. Coordinate with the Owner the exact fields that will be populated from the admissions system in the nurse-call system.
 - c. The Facility's LAN/WAN is not allowed for Nurses Call/Code Blue main wiring / function that must be a "stand alone primary cable infrastructure" as described herein.

- d. Connections to the VA LAN/WAN for functional or operable conditions will be allowed ONLY when the LAN/WAN system has been demonstrated and NFPA (at a minimum by TVE-005OP3B) Certified meeting Life Safety Standards.
 - e. Provide one (1) spare HL Interface unit.
4. Wireless:
- a. Radio Paging Equipment / Systems
 - 1) The nurse call/code blue system shall have the ability to interface ONLY with VA Certified and Licensed radio paging system (FCC Part 15 listed pagers and transmitters are not allowed for "Safety of Life" functions or installed in those specific areas – VA Headquarters TVE - 005OPB2 and SM - 005OPB2 are the 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) System shall 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 shall meet or exceed all HIPA and VA OCIS Communications Security Guidelines for the transmission of Patient or Staff Specific information aka PII – VA 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 system shall allow the operator to automatically page the staff member assigned to that room. An alternate staff member may be selected for paging purposes in place of the primary staff member. The 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 of time. The System must have the ability to assign any bed to any pager or pager group, and to assign an unlimited amount of pagers to any patient bed.
 - d) System shall have the ability to send all code blue calls to staff members by predetermined group (as required) automatically by simply pressing one "Code Blue" button. Pager shall 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 – VA Headquarters TVE - 005OP2B is the approving authority for this requirement).
 - 2) When pagers are approved, provide a minimum of ten (10) spare pagers with one spare pager for each 10 issued.
5. Personal Wireless Communicator
- a. The 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.
 - b. VA Headquarters TVE - 005OP3B and SM - 005OP2B are the approving authority for this requirement.
 - c. When communicators are approved, provide a minimum of ten (10) spare communicators for each 10 communicators issued.

6. Other Wireless Equipment / Systems
 - a. Each proposed wireless system and/or equipment to be connected to or be a part of the System, each shall meet the minimum requirements outlines in Paragraph 2.7.A.
 - b. Contact TVE - 005OP3B and SM – 005OP2B for specific required PRE approvals (full or conditional) as described herein.
 - c. When approved, TVE-005OP3B and SM-005OP2B will provide the spare equipment requirements.
 - d. When other wireless components are approved, provide ten (10) components with one spare components for each 10 issued.
- F. TIP Cable Systems: Connect the system to the TIP system provided as a part of Speciation Section 27 15 00. Provide additional TIP equipment, interfaces and connections as required by System design. Provide secured pathway(s) and lockable cabinet/rack(s) as required.
- G. Interface Equipment:
 1. TCR:
 - a. Code Blue Annunciation Station:
 - 1) The Code Blue Remote Annunciation Station shall be located in the Telephone Operators Room, Police Control Center.
 - 2) The Annunciation Station shall be connected to the System via hard wire connection(s) that shall contain all the electrical supervisory tone signals, visual bulbs, read out panel to indicate the location of the Code and system troubles.
 - 3) The System shall not be connected to the Telephone system unless specifically APPROVED BY VA HEADQUARTERS (005OP3B) and (005OP2B) PRIOR TO CONTRACT BID.
 - 4) The Annunciation Station shall be installed in a location directly viewable and the readout is completely readable from the Public Address Microphone Control Console.
 - 5) Provide one (1) spare panel.
 - b. Electrical Supervision Trouble Annunciator Panel:
 - 1) The Electrical Supervision Trouble Annunciation Panel shall be located in the Telephone Operators Room, Police Control Center, associate Nurses Station(s).
 - 2) The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end processing equipment, master stations, staff stations, patient stations, duty stations, audio power amplifier(s), UPS, power supplies, dome lights and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects a system and equipment trouble or trunk-line is malfunctioning.
 - 3) Provide one (1) spare panel.
 2. NOT USED.
 3. Nurse (aka Staff) Locator Interface:
 - a. The System must be capable of performing nurse-locator functions.
 - b. The System must be capable of performing staff-locator functions
 - c. These functions may be combined into one operation.
 - d. Provide two (2) spare interfaces.
 4. NOT USED.
 5. Pillow Speaker Interfaces:
 - a. See functional requirements herein.
 - b. Provide (1) pillow speaker for each patient station.
 - c. Provide one (1) spare pillow speaker for each twenty (20) speakers installed.
 6. TV Remote Control Interface:

- a. The pillow speaker shall have the following TV control capability:
 - 1) Play the TV audio through the pillow speaker.
 - 2) Change channels up and down.
 - 3) Increase and decrease the volume.
 - 4) TV audio mute.
 - 5) UL Certified for direct patient contact.
 - b. Provide one (1) spare interface for each 20 interfaces installed.
 7. TV Control Jack and Wiring:
 - a. Provide connection from the pillow speaker to the TV location. Terminate wire on a jack in the TV low voltage faceplate. Coordinate faceplate opening with the cabling contractor. Coordinate jack type with the TV (typically it is a ¼" jack, but verify prior to installation).
 - b. Provide patch cord from the TV control jack to the TV.
 - c. Provide one (1) spare complete assembly for each twenty (20) assemblies installed.
 8. Additional Functions / Interfaces:
 9. The nurse-call system may perform _____ additional services/ functions when specifically approved by TVE-005OP3B during the project design phases and prior to the bid process.
- H. Call Initiation, Annunciation and Response:
1. Light and Tones:
 - a. Calls may be initiated through:
 - 1) Patient station.
 - 2) Staff station.
 - 3) Code Blue station.
 - 4) Toilet Emergency Station pull cord / push button.
 - 5) Shower Emergency Station pull cord.
 - 6) Bed Pillow speaker.
 - 7) Bed Push-button cordset.
 - 8) Hospital Bed Integrated controls.
 - b. Once a call is initiated, it must be annunciated at the following locations:
 - 1) The Corridor, Intersectional and Room dome light associated with the initiating device.
 - 2) A local master control station indicating the call location and priority.
 - 3) Each duty station.
 - 4) Each staff station.
 - 5) Each remote location.
 - 6) All calls must be displayed until they are cleared by the nursing staff ONLY from the initiating device location.
 2. Voice:
 - a. Calls may be initiated through:
 - 1) Patient station.
 - 2) Staff station.
 - 3) Code Blue station.
 - 4) Toilet Emergency pull cord / push button station.
 - 5) Shower Emergency pull cord station.
 - 6) Pillow speaker.
 - 7) Push-button cordset.
 - 8) Integrated bed controls.
 - 9) Master Station.
 3. Provide two-way voice communication between a master station and patient, staff, duty and each of the two (2) remote stations.
 4. Failure of voice intercom portion of system shall not interfere with visual and audible signal systems.

5. All calls must be displayed on the master station until they are cleared by the nursing staff at ONLY the originating station. If multiple calls are received at the master station within a short period of time, they shall be stacked based on priority and wait time. If there are more calls than the master station screen can display at one time (four 4 minimum), the system must provide a simple scrolling feature. The nurse must be able to answer any call in any order at the master station. The nurse must also be able to forward calls to staff members. If a call is not answered within a programmable time period, then the system must forward the call to appropriate back-up staff identified by each shift supervisor in a manner technically approved by VA Headquarters 005OP3B.
 6. Radio pager (within the restrictions identified herein)
 7. Wireless personal communicator (within the restrictions identified herein)
- I. Auxiliary Alarm Monitoring:
1. Each patient station must have the ability to connect a separate and isolated auxiliary alarm to it such as an infusion pump or data tracking / recording device (patient life support units ARE NOT allowed to be connected to these units UNLESS APPROVED BY TVE - 005OP3B DURING THE PROJECT DEVELOPMENT PHASE AS DESCRIBED HEREIN. The System must support naming the device that is being monitored as well as display its alarms at the master station and via the room / corridor dome light(s).
 2. Provide (2) alarm jacks at each patient station.
 3. The above requirements may ONLY be allowed when the system has been approved by VA Headquarters TVE - 005OP3B and TVE - 005OP2B and concurred by the appropriate Medical Service(s) indicates it meets the minimum guidelines and requirements of Paragraph 2.8.A.
- J. Patient and Staff Assignment:
1. System may provide for transfer of one or more individual or groups of stations from one master station to another without mechanical switches or additional wiring of the stations. The transfer may be initiated manually by the nurse or automatically at certain times of the day.
 2. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring which must be a "stand alone primary cable infrastructure." Connections to the VA LAN/WAN will be allowed ONLY when the LAN/WAN system has been demonstrated and certified by TVE - 005OP3B meeting the minimum guidelines and requirements of the Life Safety Code.
- K. Reports:
1. The system's generated reports logging all calls, alarms, response time, bed, and staff assignments may be allowed to transmit these reports to a central archiving entity.
 2. Reports function shall be limited by passwords and security tier level access, so that only supervisors may access it when desired.
 3. Provide instructions to the owner on how to enable/disable the reporting functions.
 4. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring that must be a "stand alone primary cable infrastructure." Connections to the VA LAN/WAN will be allowed ONLY when the system has been demonstrated and certified by 005OP2B meeting the minimum guidelines and requirements of the Life Safety Code.
- L. System/Management Software:
1. Provide and install system/management software on minimum of three (3) owner-provided computers.
 - a. The management software shall at a minimum provide all historical reporting features of the system as well as real-time monitoring of events.
 - b. The system software shall at a minimum provide the system's operating and functioning parameters and script. The OEM shall provide VA with access to the software's script writing and functions.
 2. Provide two (2) spare CD's with the software installed and operable.

3. Rights in Data: VA shall have the right to all script and programming language of system management software. If commercial off the shelf (COTS) or a memorandum of understanding (MOU) is required for follow-on maintenance, the Contractor is required to accomplish the COTS Survey document and the RE is required to accomplish the COTS Acquisition document supplied in Part 5 Attachments herein.

M. System Functional Station:

1. Master Control:
 - a. Simple Tone and Light:
 - 1) A visual / aural (tone only) system shall be provided, protected and located in the Day Hospital, Mental Health & Blind Rehabilitation Areas, OPC where surgery or procedures are not performed. The System shall include a push-button emergency station (pull cord in Day Hospital and pushbutton in Mental Health & Blind Rehabilitation areas) with an associated corridor dome light in each dressing room (OPC) and toilet (OPC, Day Hospital, Mental Health, Blind Rehabilitation
 - 2) The visual / aural (tone only) system shall also include a power supply and a visual / aural (tone only) display panel in the respective OPC receptionist / secretary's office and the Day Hospital area and as shown on the drawings. The visual / tone display panel shall generate audible and visual emergency signals to indicate the location of a placed call.
 - 3) The Visual Display Panel shall be a digital readout touch screen to visually announce the location of incoming calls placed in the System including room and bed number and priority of the call. Identify each calling station with an individual display, including separate displays for each patient sharing a dual bedside station. If a digital readout touch screen standard is not required or approved by the Facility during the project design phase, an alpha - numeric scheme shall be provided that identifies the: ward, room and bed (i.e. Ward 2a, Room 201, Bed A (or 1) shall read 2A201A -or- 2A201-1. Equivalent readouts are acceptable as long as TVE 005OP3B and the Facility approve the readout).
 - a) Calls placed at emergency stations located in toilets and baths inside bedrooms shall be displayed for the bed closest to the nurse control station. Beds in multi-bed bedrooms shall be identified in a clock-wise pattern upon entering the bedroom.
 - b) It shall display a minimum of four incoming calls. Additional placed calls shall be stored in order of placement and priority.
 - 4) The visual / aural (tone only) system shall be installed according to the same Procedures, guidelines and standards outlined for a regular Nurse Call System for emergency NOT CODE BLUE OPERATION.
 - 5) Speakerphone and handset communication.
 - 6) Provide one (1) spare station for each ten (1) stations installed.
 - b. Touch Screen:
 - 1) Provide a touch screen master station with 15" minimum monitor size.
 - 2) The master station shall have a full control capability over staff assignment to patients and beds as well as pagers and wireless personal communication devices (when specifically approved by 005OP3B on a case by case basis).
 - 3) Speakerphone and handset communication.
 - 4) Provide one (1) spare station for each ten (1) stations installed.
2. Staff:
 - a. Light and Tine Only.
 - b. Voice Communications Enabled.
 - c. Provide one (1) spare station for each twenty (20) stations installed.

3. Duty:
 - a. Light and Tine Only.
 - b. Voice Communications Enabled.
 - c. Provide one (1) spare station for each twenty (20) stations installed.
 4. Patient:
 - a. Single & Dual:
 - 1) Provide each patient station with the following minimum
 - 2) Feature.
 - a) Call button.
 - b) Call answered button.
 - c) Pillow speaker jack.
 - d) Auxiliary alarm monitoring jack.
 - e) Hospital bed interface jack (when specially approved by TVE - 005OP3B).
 - f) Provide one (1) spare station for each twenty (20) stations installed.
- N. Distribution System: Refer to Specification Sections 27 11 00, Structured TIP Communications Cables; 27 11 00, TIP Communications Interface and Equipment Rooms Fittings and 27 15 00, HORIZONTAL and Vertical TIP Communications Cabling for additional specific TIP wire and cable standards and installation requirements used to install the Facility's TIP network.
1. In addition to the TIP provided under the aforementioned Specification Sections, the contractor shall provide the following additional TIP installation and testing requirements, provide the following minimum additional System TIP requirements, cables & interconnections:
 - a. Each wire and cable used in the System shall be specifically OEM certified by tags on each reel and recommended and approved for installation in the Facility.
 - b. The Contractor shall provide the RE a 610 mm (2 foot) sample of each wire and/or cable actually employed in the System and each certification tag for approval before continuing with the installation as described herein.
 - c. Fiberoptic Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.d. Fiberoptic Cables – for minimum technical standards and requirements for additional System cables.
 - d. Copper Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.c. Copper Cables – for minimum technical standards and requirements for additional System voice and data cables.
 - e. Line Level Audio and Microphone Cable:
 - 1) Line level audio and microphone cable for inside racks and conduit.
 - 2) Shielded, twisted pair Minimum 22AWG, stranded conductors and 24AWG drain wire with overall jacket.
 - f. Speaker Level Audio (70.7Volt RMS):
 - 1) For use with 70.7V speaker circuits.
 - 2) 18AWG stranded pair, minimum.
 - g. All cabling shall be plenum rated.
 - h. Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.
 2. Raceways, Back Boxes and conduit:
 - a. In addition to the Raceways, Equipment Room Fittings provided under Specification Sections 27 15 00 TIP Communication Room Fittings and 27 15 00 – TIP Communications Horizontal and Vertical Cabling, provide the following additional TIP raceway and fittings:
 - b. Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 & 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.
- c. Intercommunication System cable infrastructure: EMT above accessible ceilings, 24 inches on center.
 - d. Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.
 - e. Flexible metal conduit is prohibited unless specifically approved by 005OP3B.
 - f. System Conduit:
 - 1) The PA system is NFPA listed as Emergency / Public Safety Communication System which requires the entire system to be installed in a separate conduit system.
 - 2) The use of centralized mechanically partitioned wireways may be used to augment main distribution conduit on a case by case basis when specifically approved by VA Headquarters (005OP3B).
 - 3) Conduit Sleeves:
 - a) The AE 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.
 - b) 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 shall be provided by the cabling contractor.
 - g. Device Back Boxes:
 - 1) Furnish to the electrical contractor all back boxes required for the PA system devices.
 - 2) The electrical contractor shall install the back boxes as well as the system conduit. Coordinate the delivery of the back boxes with the construction schedule.
3. 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 headend location, as long as this function is specifically approved by the Telephone Contractor and the RE.
 - c. The Nurse Call Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the RE.
 - d. Provide UPS for all active system components including but not limited to:
 - 1) System Amplifiers.
 - 2) Microphone Consoles.
 - 3) Telephone Interface Units.
 - 4) TER, TR & Headend Equipment Rack(s).
- O. Patient Bedside Prefabricated Units (PBPU):
- 1. 1Where PBPU's exist in the Facility; the Contractor shall identify the “gang box” location on the PBPU designated for installation of the telephone jack. This location shall here-in-after be identified as the unit's TCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM regarding the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the TIP ceiling junction box to the PBPU's reserved gang box for the unit's TCO. A

Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation.

2. Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the Contractor in obtaining approvals and instructions in a timely manner as related to the project's time constraints.
3. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

P. Installation Kit:

1. General: The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:
 2. System Grounding:
 - a. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
 - b. This includes, but is not limited to:
 - 1) Fiberoptic Optic Cable Armor/External Braid
 - 2) Coaxial Cable Shields.
 - 3) Control Cable Shields.
 - 4) Data Cable Shields.
 - 5) Equipment Racks.
 - 6) Equipment Cabinets.
 - 7) Conduits.
 - 8) Cable Duct.
 - 9) Cable Trays.
 - 10) Interduct
 - 11) Power Panels.
 - 12) Connector Panels.
 - 13) Grounding Blocks.
 3. Fiberoptic Cable: The fiberoptic cable kit shall include all fiberoptic connectors, cable tying straps, interduct, heat shrink tubing, hangers, clamps, etc. required to accomplish a neat and secure installation.
 4. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tubing, hangers, clamps, etc., required to accomplish a neat and secure installation.
 5. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
 6. Conduit, Cable Duct, and Cable Tray: The kit shall 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.

7. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
8. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
9. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

- A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.
- B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.
- C. Contact the Office of Telecommunications, Special Communications Team (005OP2B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

- A. Coordinate with the cabling contractor the location of the TV faceplate and the faceplate opening for the nurse call TV control jack.
- B. Coordinate with the cabling contractor the location of TIP equipment in the TER, TCR, PCR, SCC, ECR, STRs, NSs, and TCOs in order to connect to the TIP cable network that was installed as a part of Section Specification 27 11 00. Contact the RE immediately, in writing, if additional location(s) are discovered to be activated that was not previously provided.
- C. Before beginning work, verify the location, quantity, size and access for the following:
 1. Isolated ground AC power circuits provided for systems.
 2. Primary, emergency and extra auxiliary AC power generator requirements.
 3. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
 4. System components installed by others.
 5. Overhead supports and rigging hardware installed by others.
- D. Immediately notify the Owner, GC and Consultant(s) in writing of any discrepancies.

3.3 NEEDS ASSESSMENT

- A. Provide a one-on-one meeting with the particular nursing manager of each unit affected by the installation of the new nurse call/code blue system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

3.4 INSTALLATION

- A. General:
 1. Execute work in accordance with National, State and local codes, regulations and ordinances.

2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.
 3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
 4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc.
 - a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
 - b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
 - c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
 - d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
 5. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and TVE 005OP3B.
 6. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommets in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
 7. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone and data equipment, systems, and service.
 8. Color code all distribution wiring to conform to the Nurse Call Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
 9. Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
 10. Product Delivery, Storage and Handling:
 - a. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
 - b. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.
 11. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
 12. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.
- B. Equipment Racks/Cabinets:
1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks/cabinets.
 2. Provide security covers for all devices not requiring routine operator control.
 3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer's recommendations regarding ventilation space between amplifiers.
 4. Provide insulated connections of the electrical raceway to equipment racks.

5. Provide continuous raceway/conduit with no more than 40% fill between wire troughs and equipment racks/cabinets for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.
 6. Ensure a minimum of 36 inches around each cabinet and/or rack to comply with OSHA Safety Standards. Cabinets and/or Racks installed side by side – the 36” rule applies to around the entire assembly
- C. Distribution Frames.
1. A new stand-alone (i.e., self supporting, free standing) PA rack/frame may be provided in each TR to interconnect the TCR, PCR, SCC, NS, STRs & ECRs. Rack/frames shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The PA riser cable shall be sized to satisfy all voice/digital requirements plus not less than 50% spare (growth) capacity in each TR which includes a fiber optic backbone.
 2. The frames/racks shall be connected to the TER/MCR system ground.
- D. Wiring Practice - in addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 – TIP Structured Communications Cabling, 27 11 00 – TIP Communications Rooms Fittings and 27 15 00 – TIP Horizontal and Vertical Communicators Cabling, the following additional practices shall be adhered to:
1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
 2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
 3. Wiring shall be classified according to the following low voltage signal types:
 - a. Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
 - b. 70V audio speaker level audio.
 - c. Low voltage DC control or power (less than 48VDC)
 4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.
 5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
 6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
 7. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
 8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
 9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
 10. Do not use tape-based or glue-based cable anchors.
 11. Ground shields and drain wires to the Facility's signal ground system as indicated by the drawings.
 12. Field wiring entering equipment racks shall be terminated as follows:
 - a. Provide OEM directed service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
 - b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products.") Provide 15% spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.

- c. If specified terminal blocks are not designed for rack mounting, utilize ¾" plywood or 1/8" thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
 - d. Employ permanent strain relief for any cable with an outside diameter of 1" or greater.
13. Use only balanced audio circuits unless noted otherwise directed and indicated on the drawings.
14. Make all connections as follows:
- a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
 - b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
 - c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
 - d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
15. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
16. Wires or cables previously approved to be installed outside of conduit, cable trays, wireways, cable duct, etc:
- a. Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.
 - b. Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.
 - c. Closer wire or cable fastening intervals may be required to prevent sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.
 - d. Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.
 - e. Completely test all of the cables after installation and replace any defective cables.
 - f. Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.
- E. Cable Installation - Cable Installation - In addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 – Structured TIP Communications Cabling, 27 11 00 – TIP Communications Rooms and Fittings and 27 15 00 – TIP Communications Horizontal and Vertical Cabling and the following additional practices shall be adhered to:
- 1. Support cable on maximum 2'-0" centers. Acceptable means of cable support are cable trays. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.

2. Run cables parallel to walls.
 3. Install maximum of 10 cables in a single row. Provide necessary rows as required by the number of cables.
 4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.
 5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
 6. Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.
 7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
 8. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 9. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 10. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
 12. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
 13. Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
 14. Serve all cables as follows:
 - a. Cover the end of the overall jacket with a 1" (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2" (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2" (minimum) past the Heatshrink and serve as indicated below.
 - b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼" past the end of unused wires, fold back over jacket and secure with cable tie.
 - c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.
- F. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for Nurse Call and/or Code Blue circuits shall be stenciled using laser printers.
1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams."
 2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
 - a. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
 - b. Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.

- c. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
 3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
 4. Termination Hardware: The Contractor shall label TCOs and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams."
 5. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
 6. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
 7. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
 8. Ensure each OEM supplied item of equipment has appropriate UL Labels / Marks for the service the equipment is performed permanently attached / marked to a non-removal board in the unit. **EQUIPMENT INSTALLED NOT BEARING THESE UL MARKS WILL NOT BE ALLOWED TO BE A PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.**
- G. Conduit and Signal Ducts: When the Contractor and/or OEM determines additional system conduits and/or signal ducts are required in order to meet the system minimum performance standards outlined herein, the contractor shall provide these items as follows:
1. Conduit:
 - a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed.
 - b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow Nurse Call and/or Code Blue cables to be installed in partitioned cable tray with voice cables may be granted in writing by the RE if requested). Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
 - c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
 - d. When "interduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
 - e. Conduit fill (including GFE approved to be used in the system) shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

- f. Ensure that Critical Care Nurse Call and/or Code Blue Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
 - a. The Contractor shall use GFE signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
 - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
 - c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.
 - d. All cable junctions and taps shall be accessible. Provide an 8" X 8" X 4" (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible

3.5 PROTECTION OF NETWORK DEVICES

- A. Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

3.6 CUTTING, CLEANING AND PATCHING

- A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.
- B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.
- C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.
- D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor's consent to cutting or otherwise altering the Work.
- E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

3.7 FIREPROOFING

- A. Where Nurse Call and/or Code Blue wires, cables and conduit penetrate fire rated walls, floors and ceilings, fireproof the opening.
- B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls and Telecommunications Rooms floors and ceilings. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.
- C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

- D. Install fireproofing where low voltage cables are installed in the same manholes with high voltage cables; also cover the low voltage cables with arc proof and fireproof tape.
- E. Use approved fireproofing tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (one inch) into each duct.
- F. Secure the tape in place by a random wrap of glass cloth tape.

3.8 GROUNDING

- A. Ground Nurse Call and/or Code Blue cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments as specified in CFM Division 27, Section 27 05 26 – Grounding and Bonding for Communications Systems.
- B. Facility Signal Ground Terminal: Locate at main room or area signal ground within the room (i.e. head end and telecommunications rooms) or area(s) and indicate each signal ground location on the drawings.
- C. Extend the signal ground to inside each equipment cabinet and/or rack. Ensure each cabinet and/or rack installed item of equipment is connected to the extended signal ground. Isolate the signal ground from power and major equipment grounding systems.
- D. When required, install grounding electrodes as specified in CFM Division 26, Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- E. Do not use “3rd or 4th” wire internal electrical system conductors for communications signal ground.
- F. Do not connect the signal ground to the building’s external lightning protection system.
- G. Do Not “mix grounds” of different systems.
- H. Insure grounds of different systems are installed as to not violate OSHA Safety and NEC installation requirements for protection of personnel.

PART 4 - ESTING / GUARANTY / TRAINING

4.1 SYSTEM LISTING

- A. The Nurses Call System is NFPA listed as an “Emergency” Communication system. Where Code Blue signals are transmitted, that listing is elevated to “Life Support/Safety.” Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

4.2 4PROOF OF PERFORMANCE TESTING

- A. Intermediate Testing:
 - 1. After completion of 30 – 40% of the installation of a head end cabinet(s) equipment, one master stations, local and remote stations, treatment rooms, and prior to any further work, this portion of the system must be pretested, inspected, and 1certified. Each item of installed equipment shall be checked to ensure appropriate UL Listing and Certification Labels are affixed as required by NFPA -Life Safety Code 101-3.2 (a) & (b), UL Nurse Call Standard 1069 and JCHCO evaluation guidelines, and proper installation practices are followed. The intermediate test shall include a full operational test.
 - 2. All inspections and tests shall be conducted by an OEM-certified contractor representative and witnessed by TVE-005OP3B if there is no local Government Representative that processes OEM and VA approved Credentials to inspect and certify the system. The results of the inspection will be officially recorded by the Government

Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75% of the system construction phase, at the direction of the RE.

B. Pretesting:

1. Upon completing installation of the Nurse Call and/or Code Blue System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
2. Pretesting Procedure:
 - a. During the System Pretest the Contractor shall verify (utilizing approved test equipment) that the System is fully operational and meets all the System performance requirements of this standard.
 - b. The Contractor shall pretest and verify that all PSM System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:
 - 1) Central Control Cabinets.
 - 2) Nurse Control Stations.
 - a) Master Stations
 - b) Patient Stations
 - c) Staff Stations
 - d) Emergency Stations
 - e) Code Blue Stations
 - 3) Dome Lights.
 - a) Patient Rooms
 - b) Corridors
 - c) Intersectional
 - 4) STRs
 - 5) Local and Remote Enunciation Panels (code blue).
 - 6) Electrical Supervision Panels/Functions/locations.
 - 7) All Networked locations.
 - 8) System interface locations (i.e. wireless, PA, telephone, etc.).
 - 9) System trouble reporting.
 - 10) System electrical supervision.
 - 11) UPS operation.
 - 12) Primary / Emergency AC Power Requirements
 - 13) Extra Auxiliary Generator Requirements.
 - 14) NSs.
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

C. Acceptance Test:

1. After the Nurse Call and/or Code Blue System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 15 working days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a TVE 005OP3B and OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety / Critical Service compliance. The tests shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System does comply with all requirements of

this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable.

3. Retesting of the entire System shall be rescheduled at the convenience of the Government and costs borne by the Contractor at the direction of the SRE.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:
 - a. The TVE 005OP3B Representative will tour all major areas where the Nurse Call and/or Code Blue System and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
 - b. The System diagrams, record drawings, equipment manuals, TIP Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
 - c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.
2. Operational Test:
 - a. After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.
 - b. Following the central equipment test, a pillow speaker (or on board speaker) shall be connected to the central terminating and nurse call master control equipment's output tap to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.
 - c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last intersectional, room, and bed dome light in each leg to verify that the nurse call distribution system meets all system performance standards.
 - d. Each MATV outlet that is controlled by a nurse call pillow speaker shall be functionally tested at the same time utilizing the Contractor's approved hospital grade HDTV receiver and TV remote control cable.
 - e. The RED system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).
 - f. Additionally, each installed emergency, patient, staff, duty, panic station, intersectional, room, and bed dome light, power supply, code one, and remote annunciator panels shall be checked insuring they meet the requirements of this specification.
 - g. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: nurse follower, three levels of emergency signaling (i.e. flashing red emergency, flashing white patient emergency, flashing white or combination lights for staff emergency, separate flashing code blue), minimum of 10 minutes of UPS operation, memory saving, minimum of ten station audio paging, canceling emergency calls at each originating station only, and storage and prioritizing of calls.
 - h. Individual Item Test: The TVE 005OP3B Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System

has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:
 - a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.
 - b. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.
- E. Acceptable Test Equipment: The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
 1. Spectrum Analyzer.
 2. Signal Level Meter.
 3. Volt-Ohm Meter.
 4. Sound Pressure Level (SPL) Meter.
 5. Oscilloscope.
 6. Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable).
 7. Patient Push Button Cord Test Set.
 8. Patient Bed with connecting multiple conductor cord.

4.3 WARRANTY

- A. Comply with FAR 52.246-21, except that warranty shall be as follows:
- B. Contractor's Responsibility:
 1. The Contractor shall warranty that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.
 2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
 3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
 4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period:
 - a. Response Time during the Two Year Guaranty Period:
 - 1) The RE (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's ONLY OFFICIAL reporting and contact official for nurse call system trouble calls, during the guaranty period.
 - 2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the RE (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.
 - b. 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
 - a) A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a pillow speaker or

- cordset, one (1) master nurse control station, patient station, emergency station, or dome light to be inoperable.
- b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The RE (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.
 - c) An emergency trouble call within four hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, or code one system to be inoperable at anytime.
- 2) 4) If a Nurse Call and/or Code Blue/ component failure cannot be corrected within four (4) hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate nurse call equipment. The alternate equipment/system shall be operational within a maximum of 20 hours after the four (4) hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the System or sub-system to full operational capability, as described herein, until repairs are complete.
- c. Required On-Site Visits during the Two Year Guaranty Period
- 1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.
 - 2) The Contractor shall arrange all Facility visits with the RE (or Facility Contracting Officer) prior to performing the required maintenance visits.
 - 3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the RE (or Facility Contracting Officer) and Contractor.
 - 4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE (or Facility Contracting Officer).
 - 5) The Contractor shall provide the RE (or Facility Contracting Officer) a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
 - a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE (or Facility Contracting Officer) by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
 - b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
 - 6) The RE (or Facility Contracting Officer) shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.

- a) The RE (or Facility Contracting Officer) shall ensure a copy of these reports is entered into the System's official acquisition documents.
 - b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the System's official technical record documents.
- C. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render.

4.4 TRAINING

- A. Provide thorough training of all nursing staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.
- B. Provide the following minimum training times and durations:
 - 1. 48 hours prior to opening for nursing staff (in 8-hour increments) – split evenly over 3 weeks and day and night shifts. Coordinate schedule with Owner.
 - 2. 32 hours during the opening week for nursing staff – both day and night shifts.
 - 3. 24 hours for supervisors and system administrators.

4.5 ATTACHMENTS

- A. The following items are required as a part of the system:
 - 1. COTS Documents:

a .

CHECKLIST FOR SOFTWARE LICENSING AGREEMENTS
 (For use in commercial item acquisition [COTS] conforming to – FAR Part 12)

The Government may not be able to accept standard commercial licensing agreement without modification; <u>you must</u> negotiate terms and conditions so it is consistent with the FAR and the VAAR.		
Is the license (check all that apply):	Yes	No
Exclusive		
Non-exclusive		
Perpetual		
Limited term		
If limited term, state the period (months or years):		
If limited term, is there an automatic renewal provision?		
CPU based		
If CPU based, state number of machines and whether simultaneous use is permitted:		
Site license		
If site license, state the site/location:		
Network license		
Other basis (e.g., # of users, # of transactions, etc.) (state specifics)		
Applicable to only the current version (doesn't apply to future versions)		
Software maintenance included at no extra cost		
Allow for office relocation or transfer		
Allow copying for backup or archival purpose		
Allow no cost copy at disaster recovery site		
Restricted on Use: (see note below)		
Restricted on the processing of data by or for user's subsidiaries and affiliates		
Restricted on processing of third party data (or use in service bureau)		
Restricted on network use		
Restricted on site and equipment limitations		
Restricted on number of users (e.g., cannot exceed _____ # of users)		
Terms and Conditions that may need to be negotiated:	Yes	No
Does the license prohibit use of the software outside of the Government? If yes, this needs to be deleted/modified if other Government contractors need access to the software (as GFP) to fulfill obligations of their own contracts.		
Does license state that the software is Year 2000 compliant or include a Year 2000 warranty? If no, must ensure it is compliant per FAR 39 or include a Y2K warranty.		
Does the license state that it provides no warranties or guarantees of any kind? If yes, need to determine whether additional warranty would be in the best interest of the Government.		
Does the license warrant that the software does not contain any code (e.g., virus) that will disable the software, and if such code exists, that Licensor agrees to indemnify the licensee (user) for all damages suffered as a result of such code? If no, need to negotiate for such warranty.		
Does the license allow access to source code? If no, negotiate for access if software will be modified or customized for the Government's needs or if the Government intends to maintain the software itself.		
Does the license require Licensor to deposit source code in escrow account? If no and source code is needed, consider negotiating for this provision, and state what "release conditions" are.		
Does the license allow the Government to hold the rights to customized code and to the data that the software manipulates? If no, negotiate for the rights if the Government (customer) requires them.		
Does the license authorize us to copy user manuals for internal purposes? If no, negotiate for authorization if multiple copies must be made for our internal use or ensure that the vendor supplies adequate number of copies. May also negotiate for updated manuals at periodic intervals, e.g., with each major update.		
Does the license state that licensee modifications to the software void all warranties? If yes, ensure that the vendor still warrants the unmodified portions.		
Does the license include clauses that prohibit needed uses of software, restrict the use of output from the software, or inappropriately burden the operation of the computer facilities? If yes, need to negotiate better terms and conditions.		
Is the dispute clause in the license consistent with FAR 52.233-1, Disputes Clause? If no, then need to modify license to be consistent with FAR.		
Does the default clause in the license allow for the Government to terminate for convenience or for cause, consistent with FAR 52.212-4(l) or FAR 52.212-4(m)? If no, then need to modify license to be consistent with FAR Part 12 (not FAR Part 49).		

b.

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS				1. REQUISITION NUMBER	PAGE 1 OF 7	
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30						
2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE SEE BLOCK 31C	4. ORDER NUMBER	5. SOLICITATION NO.	6. SOLICITATION ISSUE DATE		
7. FOR SOLICITATION INFORMATION CALL:	a. NAME		b. TELEPHONE NUMBER (No collect calls)	8. OFFER DUE DATE/ LOCAL TIME		
9. ISSUED BY:	CODE		10. THIS ACQUISITION IS <input type="checkbox"/> UNRESTRICTED <input type="checkbox"/> SETASIDE: 100 % FOR <input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> HUBZONE SMALL BUSINESS <input type="checkbox"/> 8(A) NAICS: 541511 SIZE STANDARD:	11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED <input type="checkbox"/> SEE SCHEDULE	12. DISCOUNT TERMS	
				<input type="checkbox"/> 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)		
				13b. RATING		
				14. METHOD OF SOLICITATION <input checked="" type="checkbox"/> RFQ <input type="checkbox"/> IFB <input type="checkbox"/> RFP		
15. DELIVER TO	CODE		16. ADMINISTERED BY	CODE		
			See #9 above			
17a. CONTRACTOR/ CODE OFFEROR		FACILITY CODE	18a. PAYMENT WILL BE MADE BY	CODE		
			UNITED STATES OF AMERICA Department of Veterans Affairs FMS P.O. Box 149971 Austin, TX 78714-8971			
TELEPHONE NO: 703.246-0392						

17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER

18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTIT Y	22. UNIT	23. UNIT PRICE	24. AMOUNT
	See page 2 Use Reverse and/or (Attach Additional Sheets as Necessary)				

25. ACCOUNTING AND APPROPRIATION DATA	26. TOTAL AWARD AMOUNT (For Govt. Use Only)
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27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 ARE ATTACHED. ADDENDA ARE ARE NOT ATTACHED.

27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4, 52.227-14, 52.227-16, and 52.227-19. ADDENDA ARE ARE NOT ATTACHED.

<input checked="" type="checkbox"/> 28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN <u> 1 </u> COPIES TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.	<input type="checkbox"/> 29. AWARD OF CONTRACT: REF. _____ OFFER DATED _____. YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:
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30a. SIGNATURE OF OFFEROR/CONTRACTOR	31a. UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)
--------------------------------------	--

30b. NAME AND TITLE OF SIGNER (Type or Print)	30c. DATE SIGNED	31b. NAME OF CONTRACTING OFFICER (Type or Print) Contracting Officer	31c. DATE SIGNED
---	------------------	---	------------------

AUTHORIZED FOR LOCAL REPRODUCTION COMPUTER-GENERATED
 PREVIOUS EDITION IS NOT USABLE

STANDARD FORM 1449 (REV.
 4/2002)

Prescribed By GSA - FAR (48CFR)
 53.212

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTIT Y	22. UNIT	23. UNIT PRICE	24. AMOUNT
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This Contract is Firm Fixed Price (FFP). The Contractor is required to provide the software, software license, and software maintenance services for the computer software identified below. Distribution of maintenance copies shall be accomplished by using an appropriate magnetic, electronic or printed media. Software maintenance includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers.

The name of the software is: Word 2008

License Type: Perpetual or Term????

Software Manufacturer: Microsoft

Governing Law. Federal law and regulations, including the Federal Acquisition Regulations ("FAR"), shall govern this Contract or Order (Contract/Order). Commercial license agreements may be made a part of this Contract/Order but only if both parties expressly make them an addendum. If the commercial license agreement is not made an addendum, it shall not apply, govern, be a part of or have any effect whatsoever on this Contract/Order; this includes, but is not limited to, any agreement embedded in the computer software (clickwrap) or any agreement that is otherwise delivered with or provided to the Government with the commercial computer software or documentation (shrinkwrap), or any other license agreement otherwise referred to in any document. If a commercial license agreement is made an addendum, only those provisions addressing data rights regarding the Government's use, duplication and disclosure of data (e.g., restricted computer software) are included and made a part of this Contract/Order, and only to the extent that those provisions are not duplicative or inconsistent with Federal law, Federal regulation or the incorporated FAR clauses; those provisions in the commercial license agreement that do not address data rights regarding the Government's use, duplication and disclosure of data shall not be included or made a part of the Contract/Order. Federal law and regulation, including without limitation, the Contract Disputes Act (41 U.S.C. §601-613), the Anti-Deficiency Act (31 U.S.C. §1341 et seq.), the Competition in Contracting Act (41 U.S.C. §251, et seq), the Prompt Payment Act (31 U.S.C. §3901, et seq.) and FAR clauses 52.212-4, 52.227-14, 52.227-19 shall supersede, control and render ineffective any inconsistent, conflicting or duplicative provision in any commercial license agreement. In the event of conflict between this clause and any provision in the Contract/Order or the commercial license agreement or elsewhere, the terms of this clause shall prevail. Claims of patent or copyright infringement brought against the Government as a party shall be defended by the U.S. Department of Justice (DOJ). 28 U.S.C. § 516. At the discretion of DOJ, the Contractor may be allowed reasonable participation in the defense of the litigation. Any additional changes to the Contract/Order must be made by contract modification (Standard Form 30). Nothing in this Contract/Order or any commercial license agreement shall be construed as a waiver of sovereign immunity.

See also Addendum A and B attached hereto.

1	Microsoft Word 2008 Software License, Part No. 9891-7069. Software may be installed on four separate personal computers and be used by any VA employee or support service contractor. Licenses are perpetual.	4	EA	\$10,000.00	\$40,000.00
2	12 months of Standard Microsoft Word Software Maintenance and Technical Support Services for the software being acquired under CLIN 1; Part No. 9891-7069.	4	EA	\$2,500.00	\$10,000.00
	Total				\$50,000.00

32a. QUANTITY IN COLUMN 21 HAS BEEN

RECEIVED INSPECTED ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED:

32b. SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE		32f. TELEPHONE NO. OF AUTHORIZED GOVERNMENT REPRESENTATIVE

32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	37. CHECK NUMBER
<input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL		38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT	42a. RECEIVED BY (Print)
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	42b. RECEIVED AT (Location)
41c. DATE	42c. DATE REC'D (YY/MM/DD)
	42d. TOTAL CONTAINERS

STANDARD FORM 1449 (REV. 4/2002) BACK

4.6 ADDENDUM A –ADDITIONAL TERMS AND CONDITIONS FOR CONTRACT # _____ OR ORDER# _____

A.1 Federal Acquisition Regulation (FAR) Incorporated by Reference. The Contractor agrees to comply with the following FAR clauses, which the Contracting Officer has indicated as being incorporated in this Contract/Order by reference, to implement provisions of law or executive orders applicable to acquisitions of this nature, to implement department policy or to clarify the Government's requirement. Copies of clauses in full text will be provided on request. FAR Clauses can be viewed at <http://www.arnet.gov/far/>.

FAR 52.212-4, Contract Terms and Conditions-Commercial Items (Oct 2003)
FAR 52.227-14, Rights in Data—General (Dec 2007), Alt III
FAR 52.227-16, Additional Data Requirements (Jun 1987)
FAR 52.227-19, Commercial Computer Software License (Dec 2007)

A.2 Contracting Officer's Authority. The Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this Contract, and notwithstanding any provisions contained elsewhere in this Contract/Order, the said authority remains solely within the Contracting Officer. In the event the Contractor makes any changes at the direction of any person other than the Contracting Officer, the changes will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

A.3 VAAR 852.270-1 Representatives of Contracting Officers (APR 1984). The Contracting Officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally supervise the work to be performed under this Contract/Order. Such designation will be in writing and will define the scope and limitations of the designee's authority. A copy of the designation shall be furnished the Contractor.

A.4 VAAR 852.270-4 Commercial Advertising (NOV 1984). The Contractor will not advertise the award of this Contract/Order in his/her commercial advertising in such a manner as to state or imply that the Department of Veterans Affairs endorses a product, project or commercial line of endeavor.

A.5 VAAR 852.237-70 Contractor Responsibilities (APR 1984) The Contractor shall obtain all necessary licenses and/or permits required to perform this work. He/she shall take all reasonable precautions necessary to protect persons and property from injury or damage during the performance of the Contract/Order. He/she shall be responsible for any injury to himself/herself, his/her employees, as well as for any damage to personal or public property that occurs during the performance of the Contract/Order that is caused by his/her employees fault or negligence, and shall maintain personal liability and property damage insurance having coverage for a limit as required by the laws of the state where services are performed. Further, it is agreed that any negligence of the Government, its officers, agents, servants and employees, shall not be the responsibility of the Contractor hereunder with the regard to any claims, loss, damage, injury, and liability resulting there from.

A.6 Indemnification. The Contractor shall save and hold harmless and indemnify the Government against any and all liability claims, and cost of whatsoever kind and nature for injury to or death of any person or persons and for loss or damage to any Contractor property or property owned by a third party occurring in connection with or in any way incident to or arising out of the occupancy, use service, operation, or performance of work under the terms of the Contract/Order, resulting in whole or in part from the acts or omissions of the Contractor, any subcontractor, or any employee, agent, or representative of the Contractor or subcontractor.

A.7 Government's Liability. The Government shall not be liable for any injury to the Contractor's personnel or damage to the Contractor's property unless such injury or damage is due to negligence on the part of the Government and is recoverable under the Federal Torts Claims Act, or pursuant to other Federal statutory authority.

A.10 Uniform Computer Information Transaction Act (UCITA). UCITA is not applicable to the Contract/Order.

A.11 Software License and Software Maintenance Subscription and Technical Support.

(1) Definitions.

Licensee. The term "licensee" shall mean the U.S. Department of Veterans Affairs ("VA") and is synonymous with "Government."

Licensor. The term "licensor" shall mean the software manufacturer of the computer software being acquired. The term "Contractor" is the company identified in Block 17a on the SF1449. If the Contractor is a reseller and not the Licensor, the Contractor remains responsible for performance under this Contract.

Software. The term "software" shall mean the licensed computer software product(s) cited in the Schedule of Supplies (Page 2).

Maintenance. The term "maintenance" is the process of enhancing and optimizing software, as well as remedying defects. It shall include all new fixes, patches, releases, updates, versions and upgrades, as further defined below.

Technical Support. The term "technical support" refers to the range of services providing assistance for the software via the telephone, email, a website or otherwise.

Release or Update. The term "release" or "update" are terms that refer to a revision of software that contains defect corrections, minor enhancements or improvements of the software's functionality. This is usually designated by a change in the number to the right of the decimal point (e.g., from Version 5.3 to 5.4). An example of an update is the addition of new hardware.

Version or Upgrade. The term "version" or "upgrade" are terms that refer to a revision of software that contains new or improved functionality. This is usually designated by a change in the number to the left of the decimal point (e.g., from Version 5.4 to 6).

(2) License. Grant of License and Term.

See also Addendum B.

Unless otherwise stated in the Schedule of Supplies/Services, the software license provided to the Government is a perpetual, nonexclusive license to use the software.

The license authorizes the Government to use the software in processing data for other federal agencies. If the licensed software requires a password (or license key) to be operational, it shall be delivered with the software media and have no expiration date.

If the Government decides to outsource or contract its services, the Government may allow the outsourcer to use the licensed software solely to provide the services on its behalf. The outsourcer shall be bound by the provisions of this Contract relating to the use of the software.

If the software is for use in a networked environment, as may be reflected by the number of servers or users described in the Contract/Order, the license grant provided by the Contractor includes the Government's use of the software in such environment.

Any dispute regarding the license grant or usage limitations shall be resolved in accordance with the Disputes Clause incorporated in FAR 52.212-4(d).

If the Government purchases additional licenses, the terms and conditions for those additional licenses (including technical support and upgrade subscription) shall be the same as agreed to in this Contract/Order, unless negotiated otherwise by mutual agreement of the parties.

The licensed software contains critical product functionality that meets the minimum needs of the Government and is the basis for the Government's procurement of the software; consequently, the Contractor agrees that the Government has the right to successor products at no additional cost when functionality is later unbundled from the product licensed herein and bundled into a new or different product, provided the Government is current on maintenance.

If the Contractor is a reseller for the computer software being acquired under this Contract/Order, it is permissible for the actual software manufacturer (Licensor) to deliver the software directly to the Government.

All limitations of software usage are expressly stated in the SF 1449 and Addendum A and Addendum B.

Software Maintenance Subscription and Technical Support.

Nurse Call and Code Blue Systems

See also Addendum B.

Software maintenance and technical support are included at the agreed upon price. However, if additional charges are assessed during the maintenance and technical support period as a result of negotiated changes in the license (e.g., CPU upgrades), the fee shall be by mutual agreement of the parties and any dispute thereof shall be resolved in accordance with the Disputes Clause incorporated herein at FAR 52.212-4(g).

If the Government desires to continue software maintenance and support beyond the period identified in this Contract/Order, the Government will issue a separate contract or order to renew annual maintenance and technical support. Conversely, if an order or contract to renew software maintenance and technical support is not received, no assumption by the Contractor shall be made that it has been renewed. It shall not be automatically renewed.

Unless otherwise agreed, for any new additional software that may be licensed, the Contractor shall provide for software maintenance and technical support for the first year of the license at no additional cost.

Unless otherwise agreed, the Contractor shall provide VA with software maintenance, which includes periodic updates, upgrades, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims.

Any telephone support provided by Contractor shall be at no additional cost.

All technical support services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor (e.g., www.ppirs.gov).

If the Government allows the maintenance and/or technical support to lapse and subsequently wishes to reinstate maintenance and technical support, any reinstatement fee charged shall not exceed the amounts that would have been charged if the Government had not allowed it to lapse.

A.12 Disabling Software Code. The Government requires delivery of computer software that does not contain any code that will, upon the occurrence or the nonoccurrence of any event, disable the software. Such code includes but is not limited to a computer virus, restrictive key, node lock, time-out or other function, whether implemented by electronic, mechanical, or other means, which limits or hinders the use or access to any computer software based on residency on a specific hardware configuration, frequency of duration of use, or other limiting criteria. If any such code is present, the Contractor agrees to indemnify the Government for all damages suffered as a result of a disabling caused by such code, and the Contractor agrees to remove such code upon the Government's request at no extra cost to the Government. Inability of the Contractor to remove the disabling software code will be considered an inexcusable delay and a material breach of contract, and the Government may exercise its right to terminate for cause. In addition, the Government is permitted to remove the code as it deems appropriate and charge the Contractor for consideration for the time and effort in removing the code.

A.13 Disaster Recovery Clause. Government hereby certifies to Contractor that it has a bona fide disaster plan with respect to the computer software programs used in its operations. The Contract/Order authorizes the Government's operation to maintain a second copy of software on tape for use at loading at sites that are not live (e.g. subscription-based disaster recovery services) for the sole purpose of duplicating or mirroring the software environment of the "primary" licenses at the designated licensed site and as described herein. Additionally, use of the software at the contingency sites must not include general access or any processing for program development or production. Contractor shall permit operation and testing of all licensed programs at the contingency sites as designated by the Government without prior approval and at no additional cost to the Government solely for the purpose of maintaining or implementing disaster recovery readiness including continuity of business operations. CPU's, MIPS or MSU's at these contingency sites are excluded from the total CPU's, MIPS or MSU's count included elsewhere in the Contract/Order and are not separately billable. Activation of operations at a contingency site shall be at Government's discretion. Government is authorized to install all software at the contingency sites for testing, problem resolution purposes, and to ensure there will be no operational delays in association with transition of workload from the designated licensed site to the contingency

sites. Use of the software at the contingency sites in the event of a disaster shall continue until such time as normal processing can be resumed at the "primary" site regardless of the duration required. Nothing in the Contract/Order diminishes the Government's rights in accordance with the data rights clause(s). Any license keys, codes, or passwords required by the Contractor in order to use the software at the contingency sites shall be provided to the Government within 10 days of the Government's request.

A.14 NOTICE OF THE FEDERAL ACCESSIBILITY LAW AFFECTING ALL ELECTRONIC AND INFORMATION TECHNOLOGY PROCUREMENTS (SECTION 508)

On August 7, 1998, Section 508 of the Rehabilitation Act of 1973 was amended to require that when Federal departments or agencies develop, procure, maintain, or use Electronic and Information Technology, that they shall ensure it allows Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by other Federal employees.

Section 508 required the Architectural and Transportation Barriers Compliance Board (Access Board) to publish standards setting forth a definition of electronic and information technology and the technical and functional criteria for such technology to comply with Section 508. These standards have been developed were published with an effective date of December 21, 2000. Federal departments and agencies must develop all Electronic and Information Technology requirements to comply with the standards found in 36 CFR 1194 .____*____ in performing this contract. (Fill in Section Number and Title)

ADDENDUM B – STATEMENT OF WORK FOR CONTRACT # _____ or
ORDER# _____

B.1 License. BROADLY DESCRIBE COMPUTING ENVIRONMENT AND HOW VA INTENDS TO USE THE SOFTWARE, HOW ITS LICENSED, WHAT THE SOFTWARE IS EXPECTED TO DO, ETC. TO GET YOU STARTED: The Department of Veterans Affairs (VA) has a need for the computer software identified on the Schedule of Supplies/Services (page 2) (software media and license) and software support services. The software will be installed onto multiple servers at the ITAC in Austin Texas for support/training/staging of the _____ Project. These are processor-based licenses that allow for unlimited users utilizing the processor(s). Contractor shall grant the Government the necessary license to accommodate this need. VA may move the software to any other location or hardware at any time.

B.2 Maintenance. The Contractor will provide software maintenance services, which includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims. Add detailed, specific maintenance and support information here. The Contractor will distribute maintenance updates or releases by using an appropriate magnetic, electronic, or printed media to the address in Block 15 of page one, but to the attention of Joe Smith. Alternatively, the Contractor may offer access to maintenance copies through its website. All maintenance services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor (e.g., www.ppirs.gov).

2. MOU

Department of
Veterans Affairs

Memorandum

Date: (Current Date)

From: Department of Veterans Affairs
Office of Telecommunications (005OP)
Spectrum Management (005OP2H3 – Room 047))
Telecommunications Voice Engineering (005OP2H2)
810 Vermont Avenue, NW
Washington, DC 20420

Subj: Memorandum of Understanding (MOU) for Non - VA Licensed Wireless Operations

To: Facility Director (00)
(Address)
(Address)

1. The following circumstances are the minimum necessary for conditional use of Wireless Equipment / System (s) in VA Owned or Leased Facilities (here-in after referred to as ‘the Facility’). VA Headquarters OI&T’s (005) Spectrum Management (005OP2H3), Telecommunications Voice Engineering, Special Communications (TVE - 005OP2H2) and Office of Cyber Security (OCIS – 005OP2) are the responsible entities insuring conformity of each requirement:
 - a. Each item of equipment or system whose Radio Frequency (RF) equipment is listed under Consolidated Federal Regulations (CFR), Title 47 – Federal Communications Commission (FCC), Part 15, Chapter 7, *Use of Non Licensed Devices* must be installed and operated in a manner consistent with Part 15’s “*Safety of Life*” restrictions. This information is re-emphasized in CFR, Title 15 – Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), National Telecommunications Information Administration (NTIA) *Manual of Regulations and Procedures for Federal Radio Frequency Management* (aka ‘The Red Book’).
 - b. FCC Part 15 listed RF devices ***shall not*** be Installed or used in areas where “*Safety of Life*” functions / operations are accomplished or where a ‘Code Blue’ enunciation may occur. A list of the minimum areas affected by this statement is provided as Attachment One.
 - c. If external or internal interference is detected and cannot be corrected, ***the FCC Part 15 Listed RF Equipment affected must be turned off until corrections and/or substitutions can be made.*** Contact VA’s Office of Spectrum Management (OSM – 005OP2H3), 202 461-5301 for specific conditional approval(s) concerning this issue.

3. Risk Assessment

Memorandum

Department of
Veterans Affairs

Date: (current date)
From: Director (XXXXX)
Address
Address
Address

Subj: VA Headquarters (VACO) Memorandum of Understanding (MOU) for Federal Communications Commission (FCC) Part 15 Listed "Non-Regulated Equipment Wireless Operations"

To: Department of Veterans Affairs
Office of Telecommunications (005OP)
Spectrum Management (005OP2H3)
Telecommunications Voice Engineering (005OP2H2)
1335 East West Highway, 3rd Floor
Silver Spring, Maryland 20420

1. We have received the subject VACO MOU (signed copy attached), and are pleased to provide the following information and comments for your review that includes our risks and risk-mitigation factors that prompted our Facility's decision:

a. RISK ASSESSMENT AND MITIGATION:

(1) Background:

(a) (name) VAMC (here-in-after referred to as "the Facility") has used (OEM Mdl Nr©) for over 10 years to allow nurses in the telemetry studio to communicate with nurses at the patients' bedside. This communication medium is a vital patient safety tool that allows for rapid response to the development of a potentially fatal arrhythmia such as ventricular tachycardia. The only information the telemetry technician states on the phone is "bed 109-2 Smith has an alarm for XXXXX." Last four is never communicated. In terms of the pager we have limited the information on the pager to sector, bed number and last name. We must include the last name as occasionally the patients are moved without the knowledge of the telemetry technician, if we were to have a patient mix up the page must contain the last name for safety reasons. Facility Management Services (FMS) has restricted paging access to the telemetry system only. Because pager access is restricted, only an administrator from Technology and Information Management (TIM) or FMS can troubleshoot a pager malfunction.

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(b) Because the phones are used 24X7 and have exceeded their life expectancy, many of them have begun to fail which creates a need to purchase newer models that will continue to insure system integrity.

(c) Our Facility has been prevented from purchasing replacement phones because VACO now has updated security and Information Technology (IT) connection controls along with continuing FCC Part 15 restrictions (described in the attached MOU) on devices of which these wireless phones are but one example. These updated security and connection controls are in place to address risks related life safety, information security, personal privacy and IT system integrity. The FCC restrictions continue to warn against the use of "non-regulated radio / wireless based equipment in safety of life locations and functions." Of note, these controls are intended to prevent use of these devices in areas especially where a code-blue annunciation might occur, yet our devices have been used in such areas for over 10 years and so far has not prevented a code-blue annunciation from happening.

(d) Because the Facility does not have a near-term alternative to the current wireless phones, it now faces a set of competing risks. On the one hand are the risks of privacy, connection and interference or security breach(s) that are behind the controls in place for these devices. On the other hand are risks to patient safety if the current phones were to fail and telemetry nurses would lose the ability to rapidly communicate with nurses at the bedside. Our Facility does have a Life Safety approved Nurses Call / Code Blue hardwired system that is installed in those affected areas as the primary Code Blue Enunciation media.

(2) SECURITY:

(a) NEC provides a proprietary scrambling algorithm that is applied to handset registration / authentication and all communications. Every time a (OEM Mdl Nr©) user enters a designated area within the systems' coverage; an automatic user authentication process is performed to confirm the device is authorized for service on the system. This information is scrambled using a proprietary coding scheme to prevent duplication. All voice conversations are also scrambled to enhance security.

(b) The (OEM Mdl Nr©) has several built in security features in each of the wireless handsets are administered through the Facility's Telephone Private Branch Exchange (PBX) administration tool; therefore, the PBX Administrator has full control over the (OEM Mdl Nr©) wireless phones, if one gets lost or stolen it can be disabled immediately. Because of this feature you cannot purchase a similar wireless phone and have it work on our network. These phones have a 50 ft radius from the Zone radio frequency (RF) transceiver; they can only be used within the hospital as there is no handoff via other cellular networks.

(c) These items are not NIST FIPS compliant; but based on the aforementioned facts, we feel patient / staff privacy and HIPAA instructions have been and will continue to be met.

(d) Our Facility will work with (OEM) and VACO's Office of Cyber Security (Name and Phone Nr) to secure the appropriate NIST FIPS certifications will allow VA to issue a Official Approvals from the onset in the IT equipment / system procurement process.

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(3) RADIO FREQUENCY (RF) INTERFERENCE:

(a) (OEM) engineers provided us with extensive information on the potential for RF along with electromagnetic (EM) interference to medical equipment within our Facility from the (OEM System) Wireless radio transceivers.

1) Field Experience: Since introduction of the (OEM System) Wireless product in 1996, NEC has installed this system at many health care institutions across the spectrum of medical departments. In all this time there have been zero reports of either suspected or actual RF and EM interference. This includes the experience using these devices at Portland VAMC and our continued testing documentation is available for review if requested.

2) Potential interference called Near Field Coupling: In these cases, an EM field emanating from one device may cause another device within its field area to malfunction. Typically the distances for these fields are less than six (6) inches. In attempts to mitigate these sources of interference, standards have been put in place, namely IEC 60601. This standard calls for devices susceptible to interference to provide shielding against fields of up to three (3) Volts per Meter. In contrast, the (OEM System) wireless products are classified under the FCC Part 15 rules as Class B unlicensed devices, and as such must meet very tight restrictions regarding field emissions of a maximum of from 100 to 500 micro (μ) Volts per Meter across the band of RFs from 30 Hz to 18 GHz. Thus, any medical device even marginally meeting the IEC Standard has not had problems with any near field emissions.

3) Potential phenomenon known as Far Field Induced RFI: should be considered when studying RF and EM interference sources. In this case, a part of the device subject to interference (e.g., a wire, probe, or the casing itself) can inadvertently act as a receiving antenna for a signal transmitted from another device within close proximity (within 6 to 18 inches, depending on the source power levels). To realize this type of interference, the source transmitter power must be fairly strong to conduct through the inefficient nature of the unintended antenna of the receiving device, and the material acting as the antenna must be of a shape and length that matches or is a near multiple of the wavelength of the transmitted RF signal. Finally, this unintentional antenna must not have the typical shielding between it and the subject device's electronics, which if present would prevent such a received signal from causing interference. In the case of the (OEM System) Wireless transmission, which operates between 1,920 mHz

and 1,930 mHz, a probe or such piece of any medical device measuring at about six (6) inches would match the wavelength of the RF carrier, and if not properly shielded from the units electronics may indeed conduct the RF energy within. However, even in this case, one must consider the power level at the so-called antenna receiving the signal. The average output of the (OEM Mdl Nr©) handset is approximately 10 mili (m) Watts when in use. This very low power, even further reduced by the distance between any handset in use and the subject receiving equipment, considered along with the high loss of the “antenna”, results in a very low probability of actual interference. These facts, along with the standard procedures of your engineering department’s efforts to check the medical equipment for such shielding and filtering defects, should mitigate this potential source.

4) Potential interference between intentional radiators operating in the RF band. Known as either in-band or out-of-band interference, these are cases where a transmitter broadcasts a signal of significant power at the other device’s receiver to either overload the receiving radio or mix with the subject’s transmitted signal to cause an interfered signal to be received. In-band interference
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in the Unlicensed PCS band of which the (OEM System) Wireless system operates is prevented by the FCC rules requiring our equipment to monitor the carrier on which a device intends to transmit on before doing so, so as to sense any current use by another device. If such a signal is received during monitoring, we move to another carrier and try again. This protocol has been demonstrated many times within the FCC labs as well as at many industry trade shows where 5 or more vendors with U-PCS devices have operated in booths close to each other without interference. As for out-of-band interference, because of the extremely low power our devices operate with and the very strict out-of-band emission requirements placed upon the U-PCS devices, and the additional factor of a wide separation in the operating frequencies of our system and the typical radio telemetry equipment used in many hospital environments, such interference is very remote and would require extremely close proximity of the two devices.

5) All of our (OEM Mdl Nr©) are FCC listed and has not interfered with other traffic within the same band. We expect the FCC listed (OEM Mdl Nr©) equipment will perform in the same manner.

(b) Our Facility will work with (OEM) and VACO’s Spectrum Management (005OP2H3) to find a RF band that can be utilized for this operation that will allow VA to issue a formal and Official Radio Use Permit that will negate the “unregulated equipment use” issues.

(4) CONNECTION TO IT/CABLE NETWORKS:

(a) Each item or system that attaches to a VA IT Network (telephone or data) must be Department of Commerce’s National Recognized Testing Laboratory (NRTL) Underwriters Laboratory (UL) 60950-1/2; Information Technology Equipment - Safety listed and bears UL’s mark.

1) Paragraph 1.1.1; Equipment Covered by this Standard specifically identifies these systems / networks as one affected system.

2) Paragraph 1.1.2; Additional Requirements further identifies this requirement for electromedical applications with physical connections to the patient be met.

(b) This requirement is paramount since the Facility’s Telephone PABX and associated system is listed by the National Fire Protection Association as Critical Service. Additionally, since it carries our Code Blue Radio and Overhead Audio Paging Signals, VA elevates it to Life Safety Service.

(c) Presently the (OEM Mdl Nr©) wireless phones are UL Listed but does not have the aforementioned specific UL certification. Our Facility is working with (The OEM) in this arena to have them meet or exceed this UL requirement. In the meantime we will abide within the confines outlined in the attached MOU for insuring an approved IT Network / System connection is maintained until the appropriate UL certification has been obtained allowing it to be directly connected to our telephone system.

b. The Facility Director after careful review of the attached MOU and consultation with the Facility’s CIO, (OEM) engineers, Biomedical and NFPA Engineers, ISO, HIPAA / Privacy Officer, Clinical Staff and JACHAO Officials has decided this risk-benefit analysis strongly favors purchasing replacement (OEM Mdl Nr) phones.

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2. Please feel free to contact me concerning the contents of this document.

DIRECTOR's NAME IN CAPS

cc: Office of General Counsel
Office of Telecommunications (05)
VA Enterprise Infrastructure Engineering
Telecommunications Engineering and Design
Office of Cyber Security

Attachment: VACO MOU

--- E N D ---