

SPECIFICATIONS

VOLUME 3

DIV. 27 - 34

VA Atlanta TVDD 12 Bed CLC

100% Final Bid Doc Submittal

VA Contract No.: VA36C77622R0059

VA Project No.: 508-349

VA Trink Davis Veterans Village
Carrollton, GA 30117

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**DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS**

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**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.
- 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> 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)

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.
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. Distributed (in house) Antenna System (DAS): An Emergency Radio Communications System installed for Emergency Responder (or first responders and Government personnel) use while inside facility to maintain contact with each respective control point; refer to Section 27 53 19, DISTRIBUTED RADIO ANTENNA (WITHIN BUILDING) EQUIPMENT AND SYSTEMS.

8. 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.
9. 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.
10. 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.
11. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
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 restive 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 XXIII	National 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 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction:

RUS Bull 1751F-630	Design of Aerial Cable Plants
RUS Bull 1751F-640	Design of Buried Cable Plant, Physical Considerations
RUS Bull 1751F-643	Underground Plant Design
RUS Bull 1751F-815	Electrical Protection of Outside Plants,
RUS Bull 1753F-201	Acceptance Tests of Telecommunications Plants (PC-4)
RUS Bull 1753F-401	Splicing Copper and Fiber Optic Cables (PC-2)
RUS Bull 345-50	Trunk Carrier Systems (PE-60)
RUS Bull 345-65	Shield Bonding Connectors (PE-65)
RUS Bull 345-72	Filled Splice Closures (PE-74)
RUS Bull 345-83	Gas Tube Surge Arrestors (PE-80)

3. US Department of Commerce/National Institute of Standards

Technology, (NIST) :

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/otpc/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.
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: 2013	ATSC Digital Television Standard, Part 1, Digital Television System
A/53 Part 2: 2011	ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics
A/53 Part 3: 2013	ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics
A/53 Part 4: 2009	ATSC Digital Television Standard, Part 4, MPEG- 2 Video System Characteristics
A/53 Part 5: 2014	ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics
A/53 Part 6: 2014	ATSC 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 (NESC)

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 |
| 70-2014 | | 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
99-2015	Health Care Facilities Code
101-2015	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- μ m Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)
ANSI/TIA-492AAAB-A	50- μ m Core Diameter/125- μ m 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 21, 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. Lightning protection: Section 26 41 00, FACILITY LIGHTNING PROTECTION.
16. General requirements common to more than one section in Division 28: Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
17. Conductors and cables for electronic safety and security systems: Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY.
18. Low impedance path to ground for electronic safety and security system ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR SECURITY SYSTEMS.
19. 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.
20. Physical Access Control System field-installed controllers connected by data transmission network: Section 28 13 00, PHYSICAL ACCESS DETECTION.
21. Detection and screening systems: Section 28 13 53, SECURITY ACCESS DETECTION.

22. Intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions: Section 28 16 11, INTRUSION DETECTION EQUIPMENT AND SYSTEMS.
23. Video surveillance system cameras, data transmission wiring, and control stations with associated equipment: Section 28 23 00, VIDEO SURVEILLANCE EQUIPMENT AND SYSTEMS.
24. Duress-panic alarms, emergency phones or call boxes, intercom systems, data transmission wiring and associated equipment: Section 28 26 00, ELECTRONIC PERSONAL PROTECTION EQUIPMENT AND SYSTEMS.
25. 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.
26. Emergency Call telephones, intercom systems, with blue strobe light and equipment: Section 28 52 31, SECURITY EMERGENCY CALL/DURESS ALARM/COMMUNICATIONS SYSTEM AND EQUIPMENT.

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. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.
 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. Plan for large equipment requiring positioning prior to closing in building.
 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 (0050P2H3) (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. All connections to existing facility shall be approved by COR and coordinated with equipment vendor prior to purchase. Existing system to connect to the facility are as follow:
 - 1. GetWell system
 - 2. Tek-tone 120 (nurse call system)
 - 3. AVS-PL(Overhead paging system)
 - 4. Patient WIFI
 - 5. Roam Alert
 - 6. B.M.S
- E. 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.
- F. 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.
- G. Provide delegated design submittals (e.g. seismic support design).
- H. 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.
- I. 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:
 - a. ANSI/TIA-1152 Level IV twisted pair cabling test instrument.
 - b. Fiber optic insertion loss power meter with light source.
 - c. Optical time domain reflectometer (OTDR).
 - d. Volt-Ohm meter.
 - e. Digital camera.
 3. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
 4. Provide sample test and evaluation reports.
- J. 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:
 - a. Telecommunications rooms.
 - b. Building Entrance Facility/Demarcation rooms.
 - c. Server rooms/Data Center.
 - d. Equipment rooms.
 - e. Antenna Head End rooms.
 2. Logical Drawings: Provide logical riser or schematic drawings for all systems.
 - a. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.
 3. Access Panel Schedule on Submittal Drawings: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment.
- K. Provide sustainable design submittals.
- L. 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:
 - a. Approved shop drawing for each item of equipment.
 - b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
 - c. A control sequence describing start-up, operation, and shutdown.
 - d. Description of function of each principal item of equipment.
 - e. Installation and maintenance instructions.
 - f. Safety precautions.
 - g. Diagrams and illustrations.
 - h. Test Results and testing methods.
 - i. Performance data.
 - j. 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.
 - k. Warranty documentation indicating end date and equipment protected under warranty.
 - l. 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:
 - a. Final room numbers and actual backbone cabling and pathway locations and labeling.
 - b. Inputs and outputs of equipment identified according to labels installed on cables and equipment
 - c. Device locations with labels.
 - d. Conduit.
 - e. Head-end equipment.
 - f. Wiring diagram.
 - g. Labeling and administration documentation.
 5. Submit Record Wiring Diagrams within five business days after final cable testing.
 6. Deliver Record Wiring Diagrams as CAD files in .dwg or .rvt formats as determined by COR.
 7. 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 eight 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:
 - a. Components of an assembled unit need not be products of same manufacturer.
 - b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
 - c. Provide compatible components for assembly and intended service.
 - d. Constituent parts which are similar must be product of a single manufacturer.
 - 4. 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:
 - a. Store and protect equipment in a manner that precludes damage or loss, including theft.
 - b. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.
 - c. 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.
 - 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.
- B. Modification to administrative issues requires written approvals from COR with concurrence from SMCS 0050P2H3, OEM, contractor, and local authorities.

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 minimum 2.108 mm (14 gauge) steel and acceptable for 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 0050P2H3, 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.

2.9 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.
 - a. Fill spaces in openings after installation of conduit or cable.
 - b. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
 - c. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
 7. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
 8. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
 9. Annular space between conduit and sleeve must be minimum 6 mm (1/4 inch).
 10. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.
 11. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
 12. Do not support piping risers or conduit on sleeves.
 13. Identify unused sleeves and slots for future installation.
 14. 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.
 - a. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
 - b. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
2. 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:
 - a. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
 - b. 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:
 1. Remove samples of installed work as specified for testing.
 2. Perform cutting, fitting, and patching of equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new work.
 3. Remove and replace defective work.
 4. Remove and replace non-conforming work.
- B. Cut, remove, and legally dispose of selected equipment, components, and materials, including removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new work.
- C. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
- D. Protect adjacent installations during cutting and patching operations.
- E. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- F. 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 6a 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:
 - a. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
 - b. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
 - c. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
10. 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.
11. Provide results of interim inspections to COR.
12. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
 - a. Additional inspections are scheduled at direction of COR.
 - b. Re-inspection of deficiencies noted during interim inspections, must be part of system's Final Acceptance Proof of Performance Test.
 - c. The interim inspection cannot affect the system's completion date unless directed by COR.

13. 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:
 - a. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
 - b. 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.
 2. 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:
 - a. MCR interconnections.
 - b. TER interconnections.
 - c. Control room interconnections.
 - d. TR interconnections.
 - e. System interfaces in locations listed herein.
 - f. Communications circulating ground system.
 - g. Emergency generator interconnections.
 - h. Each general floor areas.
 - i. Others as required by AHJ (SMCS 0050P2H3).
 3. 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:

- a. COR.
- b. OEM representatives.
- c. VACO:
 - 1) CFM representative.
 - 2) AHJ-SMCS 0050P2H3, (202)461-5310.
- d. VISN-CIO, Network Officer and VISN representatives.
- e. 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.
- f. Local Community Safety Personnel:
 - 1) Fire Marshal representative.
 - 2) Disaster Coordinator representative.
 - 3) EMS Representatives: Police, Sherriff, City, County or State representatives.
- 4. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
 - a. 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 0050P2H3) 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:
 - a. Without Acceptance: Until system fully meets conditions of construction documents, system's ownership, use, operation and warranty commences at Government's final acceptance date.
 - b. 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.
 - c. 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 0050P2H3) 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 specifies grounding and bonding requirements of communications installations based on the requirements of ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises. Work covered by this Section shall consist of furnishing supplies, labor, materials, equipment, labeling, and tools. Testing is required unless otherwise specified. An operable grounding and bonding infrastructure is required as described on the Drawings and/or required by these specifications. All materials shall be listed by a nationally recognized testing laboratory (NRTL).

1.2 SUMMARY

Section Includes:

- A. Required Bonding Busbars.
- B. Supplemental Bonding Networks.
- C. Telecommunications Bonding Conductors.
- D. Joining Requirements.
- E. Overvoltage Surge Protectors.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.
- B. ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- C. NFPA 70, National Electrical Code (NEC).
- D. International Annealed Copper Standard (IACS).

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E. BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.
F. UL 497 & UL 497A, UL Standards for Primary & Secondary Safety Protectors for Paired-Conductor Communications Circuits.

1.4 RELATED WORK

- A. Facility grounding and bonding requirements: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Information Technology equipment enclosures: Section 27 11 16, COMMUNICATION CABINETS, RACKS, FRAMES, AND ENCLOSURES.
- C. Cable trays: Section 27 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.
- B. Provide riser diagram indicating location of communications grounding system connections indicating routing of grounding conductors.
- C. Closeout Submittals: Provide test reports of ground resistance to each primary or secondary bonding busbar (PBB/SBB) located in each telecommunications space impacted by the work.

PART 2 - PRODUCTS

2.1 BONDING BUSBARS.

Bonding busbars are located in each telecommunications space and in each network rack/cabinet. Bonding busbars provide common

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locations in the telecommunications space for the connection of the telecommunications bonding conductors.

A. Common Requirements.

1. Provided with holes for use with correctly-matched UL Listed two-hole lugs and hardware.
2. Constructed of copper or copper alloy with a minimum of 95% conductivity when annealed.
3. Annealed as specified by the International Annealed Copper Standard (IACS).
4. Installation resulting in a maximum 4.0Ω to ground resistance measured from any point in the system.
5. Installation is insulated from the mounting surface through the use of appropriate insulators.
6. UL Listed.

B. Primary Bonding Busbar (PBB). The PBB is a dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The PBB also serves as the central attachment point for Secondary Bonding Busbars (SBB) via Telecommunications Bonding Backbone (TBB).

1. Pre-drilled copper with holes to accommodate lug mounting holes.
2. Sized for current applications and future growth.
3. Insulated from its supports.
4. Electro-tin plated is acceptable.
5. Maintain a 2" min clearance between busbar and finished wall.
6. Size must be 0.25" thick by 4" wide by 20" length.

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c. Rack Bonding Busbar (RBB). The RBB is a busbar located in a cabinet, rack, or frame.

1. Mounting. Horizontal mounting to an EIA-310-D 19" equipment rack is specified.
2. Capacity: 10 Double-hole lugs.
3. Size & material 0.75" wide x 19" length x 0.25" thick - Copper or tin annealed copper.

2.2 SUPPLEMENTAL BONDING NETWORKS.

Also known as Signal Reference Grids (SRGs), Mesh Bonding Networks (Mesh-BN), or Isolated Bonding Networks (IBNs), the requirements for supplemental bonding networks are not specified in this document. Supplemental bonding networks may not be used to replace a standards-compliant bonding infrastructure.

2.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB).

The TBB bonds the facility Primary Bonding Busbar (PBB) to telecommunications space Secondary Bonding Busbars (SBBs).

- A. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.
- B. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D and will be as straight as practicable avoiding bends.
- C. Bonding the TBB to the PBB and each SBB will require a UL Listed irreversible compression (crimp) dual-lug connector.

2.4 BONDING CONDUCTORS.

- A. Telecommunications Equipment Bonding Conductor (TEBC). The TEBC connects the cabinets and racks in the telecommunications space to the space's bonding busbar (PBB or SBB).

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1. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.
 2. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D. The minimum size for the TEBC shall be AWG 6.
 3. Bonding. Bonded to the telecommunications space bonding busbar (PBB or SBB) via a UL Listed two-hole compression lug. Rack Bonding Conductors (RBCs) are connected to the TEBC using UL Listed irreversible compression (crimp) connectors.
- B. Rack Bonding Conductor (RBC). The RBC is a bonding conductor from the cabinet or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
1. Material. Stranded copper wire with a green jacket run as a continuous conductor.
 2. Size. The minimum size for the RBC shall be AWG 6.
 3. Bonding. Bonded to the Telecommunications Equipment Bonding Conductor (TEBC) using UL Listed irreversible compression (crimp) connectors.
 - a. Where connected to a server cabinet, the RBC extends to the bottom of the server cabinet allowing Equipment Bonding Conductors to be attached at any point in the cabinet.
 - b. Where connected to a network rack/cabinet, the Rack Bonding Conductor (RBC) is bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug.
- C. Equipment/Unit Bonding Conductor (EBC/UBC). The Equipment/Unit Bonding Conductor connects individual

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equipment in a cabinet or rack to the Rack Bonding Conductor (RBC) or Rack Bonding Busbar (RBB). Equipment Bonding conductors are also used as cable tray bonding conductors to bond cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC).

1. Material. Stranded copper wire with a green jacket run as a continuous conductor.
2. Size. The minimum size for the RBC shall be AWG 6.
3. Bonding.
 - a. Where used in a server cabinet, bonded to the Rack Bonding Connector (RBC) using UL Listed irreversible compression (crimp) connectors and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)
 - b. Where used in a network cabinet/rack, bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)
 - c. Where used as a cable tray bonding conductor connecting cable tray sections, bonded to each adjoining section of the cable tray using UL Listed two-hole compression lugs.
 - d. Where used as a cable tray bonding conductor connecting cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC), bonded to the TEBC using UL Listed irreversible compression (crimp) connectors and to the cable tray via a UL Listed two-hole compression lug.

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4. Contractor shall furnish a minimum of ten (10) EBCs for each RBB. Five (5) EBCs shall be outfitted as described here and shall be six (6) feet in length. Five (5) EBCs shall be outfitted as decried here and shall be nine (9) feet in length. Contractor shall use field measurements to determine EBC cable length when directed by VA project managers.

2.5 OVERVOLTAGE SURGE PROTECTORS.

- A. Protectors are voltage-limiting devices intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents in communications lines caused by lightning, contacts with power conductors, power induction, and rises in ground potential.

1. Compliance. Protectors shall be compliant with UL 497 and/or UL 497A, as applicable.
2. Performance. Protectors shall be rated to support copper UTP performance Category 5e at 100MHz.
3. Protection. Voltage suppression shall be via low capacitance solid state protectors only, rated at 18V for copper backbone applications or 65V for VOIP or PoE applications.
4. Construction. Provide protection for each pair.
5. Termination shall be insulation-displacement contact.
6. Mounting. Protectors shall be wall-mounted.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

- A. Components of the telecommunications bonding system will be installed and connected using materials and techniques required

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by ANSI/TIA-607-D. The use of antioxidant joint compound is required for all connections excluding protector 110 block connections.

B. Testing.

1. Perform tests per BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.
2. Perform two-point bond test using trained installers qualified to use test equipment.
3. Conduct continuity tests to verify that metallic pathways in telecommunications spaces are bonded to PBB or SBB.
4. Conduct electrical continuity test to verify that PBB is effectively bonded to the facility grounding electrode conductor.
5. Perform resistance tests to ensure rack and cabinet bonding connection resistance measures less than 4Ω to PBB or SBB.

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SECTION 27 05 33
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies conduit, fittings, and boxes to form raceway systems for communications cabling.

1.2 RELATED WORK

- A. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.
- B. Fabrications for deflection of water away from building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- C. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.
- D. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.
- 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. In accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS, submit the following:
 - 1. Size and location of cabinets, splice boxes, and pull boxes.
 - 2. Layout of required conduit penetrations through structural elements.

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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.

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.

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- 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.
 - 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

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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:

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- 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. 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.
8. 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.

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- 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.
- 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.

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5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.
- F. 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".
- G. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:
 1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway.
 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, ignitibility, and toxicity requirements of environmental air space.
 5. Size: Metric Designator 53 (trade size 2) or smaller.
 6. Outside Plant: Plenum-rated where each innerduct 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.

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9. Provide innerduct reel lengths as necessary to ensure ducts are continuous.
 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.
- H. 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. 2-Gang Tile Box:
 - a. Flush backbox type for installation in block walls.
 - b. Minimum 92 mm (3-5/8 inches) deep.
- I. 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.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Penetrations:
1. Cutting or Holes:
 - a. Locate holes in advance of installation. Where 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 and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand

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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: Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS

B. 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) or every 100ft. 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 TR or interstitial space at top or bottom of backboard. Install

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- 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 to prevent entrance of moisture and gases and to meet fire resistance requirements.
 8. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
 9. Complete each entire conduit run installation before pulling in cables.
 10. Flattened, dented, or deformed conduit is not permitted.
 11. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
 12. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
 13. Install conduit mechanically continuous.
 14. 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).
 15. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
 16. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
 17. Conduit installations under fume and vent hoods are prohibited.

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18. 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.
19. Do not use aluminum conduits in wet locations.
20. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors and ceilings.
21. 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.
 - d. Minimum radius of communication conduit bends:

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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)

22. 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.

c. 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.

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- 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.
- D. Furred or Suspended Ceilings and in Walls:
1. Rigid steel, 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.
- E. 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.

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4. Support horizontal or vertical runs at not over 2400 mm (96 inches) intervals.

5. 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.

F. 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.

G. 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.

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4. Install green copper wire minimum #6 AWG in flexible conduit for bonding jumper.

H. 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.

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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.
- I. Box Installation:
1. Boxes for Concealed Conduits:
 - a. Flush mounted.
 - b. Provide raised covers for boxes to suit wall or ceiling, construction and finish. In spaces not controlled by VA (i.e., common hallways) covers must be lockable.
 2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.

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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.
- J. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:
1. Install Innerduct in cable tray. Innerduct may not be free-hung.
 2. Install only in accessible spaces not subject to physical damage or corrosive influences.
 3. Make bends manually to assure internal diameter of tubing is not effectively reduced.
 4. 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 and resistance to ground.

- - - E N D - - -

SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications cabling cable tray and raceway equipment.

1.2 SUMMARY

Section Includes:

- A. Cable Tray.
- B. Fiber Optic Cable Raceway.
- C. Ladder Rack.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Grounding and bonding: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 CABLE TRAY.

- A. Design. Wire basket with tray insert. Maximum 2" x 4" wire mesh construction. Constructed of round, smooth wire with continuous top side to minimize cable sheath damage.
- B. Finish. Coated to prevent rust.
- C. Size. Cable tray shall be sized to hold the maximum expected cable load at not more than 40% fill and not more than 6" maximum cable depth.
- D. Accessories. Provide and install the following components and accessories as necessary to achieve the design:
 - 1. Overhead mounting equipment (thread-rod, unistrut, nuts, washers, etc.) suitable for the supporting structural elements.
 - 2. Tray section splicing hardware.
 - 3. Tray insert.

4. Cable waterfalls.
5. Ground strap kits.
6. Bend radius limiters.

2.2 FIBER OPTIC CABLE RACEWAY.

- A. Design. Raceway system shall be a modular system of channels, fittings, and brackets, able to be assembled with couplers. Fittings for cable spillout shall maintain a minimum 2" bend radius.
- B. Materials. Raceway shall be constructed of rigid PVC and ABS plastics.
- C. Size. Raceway shall be nominally sized 4"x4".
- D. Accessories. Provide and install the following components and accessories as necessary to achieve the design:
 1. Overhead mounting equipment (thread-rod, unistrut, nuts, washers, etc.) suitable for the supporting structural elements.
 2. Hinged channel covers.
 3. Raceway section couplers.
 4. Channel corners and intersections.
 5. Spillway fittings.

2.3 LADDER RACK.

- A. Design. Ladder rack system shall be a modular system of ladder, turns, splices, supports, and accessories able to be assembled with couplers.
- B. Finish. Coated to prevent rust.
- C. Materials. Ladder rack shall be manufactured from steel and extruded aluminum. Stringers will be 3/8" by 1-1/2" steel. Cross members will be 1" x 1/2" T-shaped. Steel elements shall have a minimum 0.065" wall thickness.
- D. Size. Ladder rack shall be nominally sized 12" width.
- E. Accessories. Provide and install the following components and accessories as necessary to achieve the design:
 1. Overhead mounting equipment (thread-rod, unistrut, nuts, washers, etc.) suitable for the supporting structural elements.
 2. Ladder rack section couplers (splices).
 3. Ladder rack radius bends.
 4. Ground strap kits.

PART 3 - EXECUTION

3.1 IMPLEMENTATION:

- A. Cable tray shall be used in horizontal applications. Ladder rack is used in vertical applications.
- B. Cable tray and ladder rack sections shall be bonded together with bonding conductors and the system bonded to the bonding busbar in the space.
- C. Support horizontal cable tray not less than every 5' (shorter spans if recommended by the equipment manufacturer).

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**SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies labeling and identification requirements for information technology (IT) equipment cabinets, racks, and cabling.

1.2 SUMMARY

Section Includes:

- A. Equipment and component labels.
- B. Labeling implementation requirements.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Server cabinets and network racks: Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.
- B. Cable management equipment: Section 27 11 23, COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK.
- D. Fiber optic cabling: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND COMPONENT LABELS.

- A. Materials. Materials used for labeling equipment, components, and telecommunications cabling shall be appropriate for the installation environment, durable and permanent, and heat-resistant if necessary for labeling in high-temperature environments.

PART 3 - EXECUTION

3.1 IMPLEMENTATION:

- A. Governing Standard. Labeling and identification of equipment, components, and telecommunications cabling shall be based on ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure, and NFPA 70, National Electrical Code, as modified by guidance in the VA Infrastructure Standard for Telecommunications Spaces.

- B. All passive infrastructure equipment, components, and telecommunications cabling installed shall be labeled at the time of installation.
- C. Telecommunications cable labeling shall include delivery of complete and accurate connection documentation (where each cable terminates at each end) matching the installed labels.
- D. Label locations shall be as specified in the VA Infrastructure Standard for Telecommunications Spaces.

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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 REQUIREMENTS 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

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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.

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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
STRUCTURED CABLING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications structured cabling systems.

1.2 SUMMARY

Section Includes:

- A. Computer Room Backbone Structured Cabling.
- B. Computer Room Horizontal Structured Cabling.
- C. Facility Backbone Structured Cabling.
- D. Facility Horizontal Structured Cabling.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Cabling labeling and identification: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- B. Cable termination locations and equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COMPUTER ROOM BACKBONE STRUCTURED CABLING.

Backbone structured cabling in the computer room environment (first level backbone) connects the Main Distribution Areas (MDAs) to the Horizontal Distribution Areas (HDAs).

- A. Install first level backbone structured cabling in overhead underfloor cable tray and fiber raceway systems following diverse path routing.
- B. All cabling used shall be pre-terminated and procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.
- C. Terminate first level backbone structured cabling in the top RU positions of each network rack, working downward, with patch panel equipment mounted on the front rails.
- D. Mirror distribution on the A-side and B-side MDA and HDA elements.

1. In MDA network racks:
 - a. Install angled UTP patch panel(s) for each backbone UTP patch panel in the same-side HDA in the computer room beginning in RU45.
 - b. Install an angled panel cover on the lowest UTP patch panel.
 - c. Install a blanking panel in the RU below the UTP patch panels.
 - d. Install fiber optic distribution cabinets to support the backbone fiber distribution from each HDA.
 - e. Install a blanking panel in the RU below the fiber optic distribution cabinet(s).
 2. In HDA network racks:
 - a. Install fiber optic distribution cabinet(s) and populate with fiber optic distribution cassettes starting in RU45.
 - b. Install a blanking panel in the RU below the last fiber cabinet.
 - c. Install UTP patch panel(s) below the blanking panel.
 - d. Install a blanking panel in the RU below the last UTP patch panel.
- E. Install UTP cables between the same-side MDAs and HDAs.
- F. Install 12- or 24-strand multimode fiber optic cables between each fiber cassette in the HDA to either the same-side MDA or the opposite side MDA as appropriate.

2.2 COMPUTER ROOM HORIZONTAL STRUCTURED CABLING.

Horizontal structured cabling in the computer room environment connects the Equipment Distributors (EDs) in the server cabinets to each supported Horizontal Distribution Area (HDA).

- A. Install horizontal structured cabling in overhead cable tray and fiber raceway systems following diverse path routing.
- B. All cabling used shall be pre-terminated and procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.
- C. In the server cabinets, terminate horizontal structured cabling in EDs located in the top 5U of each cabinet, with patch panel equipment mounted on the rear rails.
 1. Install fiber optic distribution cabinet(s) starting in RU45 and populate with fiber optic distribution cassettes to support the requirement.

2. Install a blanking panel in the RU below the last fiber cabinet.
 3. Install copper UTP patch panel(s) below the blanking panel.
- D. In the HDAs, terminate horizontal structured cabling in the RU positions immediately below the first level backbone structured cabling equipment of each network rack , working downward, with patch panel equipment mounted on the front rails.
1. Install fiber optic distribution cabinet(s) and populate with fiber optic distribution cassettes to support each server cabinet.
 2. Install a blanking panel in the RU below the fiber optic distribution cabinet(s).
- E. Install 12- or 24-strand multimode fiber optic cables between the server cabinet ED and both HDAs.
- F. Install UTP cables between the server cabinet ED and both HDAs.

2.3 FACILITY BACKBONE STRUCTURED CABLING.

Backbone structured cabling (inter-building and intra-building first level backbone) connects the Entrance Rooms to the Main Distribution Areas (MDAs) in the computer room, and connects the Main Distribution Areas to each Telecommunications Room (TR). This specification describes facility backbone structured cabling when the Entrance Rooms and computer room are in the same building, connected entirely by environmentally conditioned pathways (no outside plant pathways are transited).

- A. Interior to each telecommunications space, install facility backbone structured cabling in overhead cable tray and fiber raceway systems.
- B. All facility backbone structured cabling shall be redundant and follow diverse path routing.
- C. Facility backbone cabling shall be field-terminated (fusion spliced).
- D. In the Entrance Room, MDA, and TR network racks designated for facility backbone distribution, install fiber optic distribution cabinets as required for the quantity of fibers installed.
- E. Between each MDA and each TR:
 1. No zone/intermediate distribution areas (ZDAs/IDAs) intermediate cross-connects (ICCs) shall be used. All facility backbone cabling between the MDAs and TRs shall be run directly and continuously.
 2. Provide 2 diversely routed paths of backbone cabling, one from the A-side MDA and one from the B-side MDA.

3. Where the TR is located in the same building as the computer room MDAs (does not transit outside plant pathways) and the path distance is less than 400 meters, install a minimum of 24 strands of multimode fiber optic cabling and 12 strands of single-mode fiber optic cabling per path.
 - a. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of multimode OM4 and single-mode OS1 fiber optic splice cassettes per path.
4. Where the TR is located in a different building as the computer room (transits outside plant pathways) or the path distance is greater than 400m, install a minimum of 24 strands of single-mode fiber optic cabling per path.
 - a. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of single-mode OS2 fiber optic splice cassettes per path.

2.4 FACILITY HORIZONTAL STRUCTURED CABLING.

Facility horizontal structured cabling (horizontal distribution) connects the Telecommunications Room (TR) to each end-user Work Area Outlet (WAO).

- A. Interior to each TR, install horizontal distribution structured cabling in overhead cable tray systems.
- B. All horizontal distribution structured cabling shall have a minimum of 2 cables per WAO.
- C. Horizontal distribution structured cabling may be field-terminated.
- D. In each TR install sufficient UTP patch panels to support the quantity of WAOs in the TR's serving zone.
 1. Plan network racks such that patch panels and horizontal cable managers are located in the top 1/3 (RU31-45), switching equipment in the middle 1/3 (RU16-30), and power distribution and other services in the bottom 1/3 (RU1-15).
- E. Install a minimum of 2 UTP cables between the TR UTP patch panels and each work area faceplate.
- F. Each typical end-user receptacle shall be constructed of a single-gang workbox with one connector chassis, a minimum of two non-proprietary Category 6A 8P8C media interface connectors (RJ-45), and a four-position keystone faceplate.

1. Modular plug terminated links (MPTL) are permitted to service wireless access points (WAPs), cameras, and other Power over Ethernet (PoE) devices where mating will be very infrequent.

PART 3 - EXECUTION

3.1 IMPLEMENTATION:

- A. 100% construction drawing sets shall include drawings detailing the computer room and facility/campus structured cabling systems, including:
 1. Cable media performance categories for each type of run.
 2. Cabling and equipment quantities.
 3. Elevation drawings showing equipment placement in individual enclosures.
 4. Full interconnection diagram for all structured cabling.
 5. Port map and cable label matrices.
- B. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies Information Technology (IT) equipment enclosures for use in VA telecommunications spaces.

1.2 SUMMARY

Section Includes:

- A. Server Cabinets.
- B. Network Channel Racks.
- C. Network Cabinets.
- D. Telecommunications Enclosures.
- E. Pathway Racks.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Cabling termination equipment, rack-mounted: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.
- B. Cable management equipment: Section 27 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.
- C. Power distribution equipment: Section 27 11 26, COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS.
- D. Grounding and bonding equipment: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- E. Labeling and identification requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- F. Seismic bracing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 NETWORK CHANNEL RACKS.

- A. Height. Racks shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

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B. Dimensions. Nominal dimensions for network racks are 86" (2184mm) tall, 24" (610mm) wide, and 40" (1220mm) deep (30"/762mm between front and rear mounting rails).

C. Side Panels. The rack shall have integral metal side panels (a "channel" rack) constructed with a cable management pattern of staggered shapes (circles, hexagons, etc.) to allow for connection points for cable management accessories.

D. Security Doors. Provide locking, latched, hinged metal doors and mounting hardware for the network rack. Doors shall be perforated with a minimum of 50% open design for airflow.

1. Locks. All locks on a network rack shall be keyed the same. Provide two keys per cabinet.

E. Color. The rack and all components shall be white in color.

F. Equipment Mounting Rack. The rack shall provide an EIA-310-E compliant 19" racking system with front and rear rails using standard 3/8" x 3/8" square hole mounting .

G. Components. The rack shall be supplied with the following standard equipment:

a. Toolless mounting brackets for vertical Rack PDUs.

b. 30U of 1RU blanking panels.

c. Vertical cable managers with doors on both left and right of the rack (size commensurate with the requirement).

d. Cable management accessories as necessary to maintain cable bend radii, uniformity, and neatness (e.g. d-rings, spools, bend radius limiters, finger cable managers, waterfalls, etc.).

2.4 TELECOMMUNICATIONS ENCLOSURES (TE) .

Telecommunications Enclosures (TEs) are swing-out wall-mounted enclosures.

A. Height. TEs shall provide 26 standard rack units (RU) of space for mounting equipment.

B. Dimensions. Nominal dimensions for server cabinets are) 48" (1220mm) tall, 24" (610mm) wide, and 30" (760mm) deep.

C. Doors and Panels.

1. Front Door. TEs shall have a single locking, latched, hinged metal front door with a tempered glass front.

2. Rear Panel. TEs shall have a latched, hinged metal rear door that mounts to the wall, allowing the body of the TE to be swung open for rear equipment access. If latched exterior to the body of the TE, the latch shall be locking.

a. Cabling Cutouts. The top and bottom surfaces of the rear panel shall have cabling cutouts to accommodate telecommunications cabling entering the TE. Edge-protection grommets for the cabling cutouts shall be provided.

b. Power Cutout. The rear panel shall have a cutout on the rear mounting surface allowing power to be installed internal to the TE.

3. Locks. All locks on a TE shall be keyed the same. Provide two keys per TE.

- D. Load Rating. The TE shall support 300lb (136kg) of total weight.
- E. Color. The cabinet and all components shall be white in color.
- F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19" racking system with front and rear rails using standard threaded #12-24 hole mounting.
- G. Components. The cabinet shall be supplied with the following standard equipment:
 - a. 1U shelf (two per TE).
 - b. Vertical cable management kits (one per each full 12U of TE height).
 - c. Fan kit to evacuate heat generated by active equipment (two per TE).
 - d. Filter kit for fans (two per TE).

2.5 PATHWAY RACKS.

- A. Height. Pathway racks shall provide a minimum of 5 standard rack units (RU) of space (5U) for mounting Equipment Distributor equipment.
- B. Dimensions. Nominal dimensions for pathway racks are 12.6" tall, 23.6" wide, and 9" deep.
- C. Mounting. Pathway racks shall mount to standard basket-style cable tray.
- E. Color. Pathway racks shall be white in color.
- F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19" racking system with rails using standard 3/8" x 3/8" square hole mounting .

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Where to be installed in structures assigned to Seismic Design Category C, D, E, or F, seismic bracing equivalent to that for other storage racks per VA Master Specification 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS section 3.7 ("Install... to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements") is required.
- B. Casters on floor-mounted enclosures shall be retracted and the enclosures leveled and stabilized.

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SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cable termination and management equipment to be mounted in information technology (IT) equipment cabinets and racks.

1.2 SUMMARY

Section Includes:

- A. Copper UTP Patch Panels.
- B. Fiber Optic Distribution Cabinets.
- C. Fiber Optic Distribution Cassettes.
- D. Fiber Optic Splice Cassettes.
- E. Horizontal Cable Managers.
- F. Blanking Panels.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Server cabinets and network racks: Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.
- B. Cable management equipment: Section 27 11 23, COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK.
- C. Labeling and identification requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- D. Copper UTP cabling: Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.
- E. Copper UTP cabling termination: Section 27 13 13.13, COMMUNICATIONS COPPER CABLE SPLICING AND TERMINATIONS.
- F. Fiber optic cabling: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.
- G. Fiber optic cabling termination: Section 27 13 23.13, COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COPPER (UTP) PATCH PANELS.

A. Form Factor. 1U, 19" rack-mountable. Default form factor for patch panels shall be angled to extend not less than 4" (104mm) forward from the mounting rail.

B. Capacity. 48 copper 8P8C ports in groupings of 6.

C. Interface. Copper (UTP) patch panels shall accept pre-terminated single 8P8C keystone jacks and 6-jack cassettes.

D. Accessories. Provide each patch panel installation with the following accessories.

1. Angled panel cover. Specify angled panel covers at the top and bottom of each stack of angled patch panels. Covers shall mount to the same RU rail positions as the top and bottom patch panels.

2. Rear cable manager tray. Specify one rear cable manager tray per patch panel. Trays shall mount to the same RU rail positions as the patch panel.

2.2 FIBER OPTIC DISTRIBUTION CABINETS.

A. Form Factor. 1U, 19" rack-mountable, angled to extend not less than 4" (104mm) forward from the mounting rail.

B. Capacity. 144 fibers in a variety of distribution and/or splice cassettes.

C. Door. Cabinets shall be supplied with a locking front cover.

D. Accessories. Provide each distribution cabinet with the following accessories.

1. Rear cable manager. Specify one rear cable manager with fiber storage rings per distribution cabinet. Trays shall mount to the same RU rail positions as the distribution cabinet.

2. 0RU patch cord managers. Specify one pair of patch cord managers per distribution cabinet. Managers shall mount to the same RU rail positions as the distribution cabinet and rear cable manager.

2.3 FIBER OPTIC DISTRIBUTION CASSETTES.

Fiber optic distribution cassettes are used in structured cabling in the computer room to connect Main Distribution Areas (MDAs), Horizontal Distribution Areas (HDAs), and Equipment Distributors (EDs) where pre-terminated cable is used.

- A. Form Factor. Designed to install in rack-mounted fiber optic distribution cabinet.
- B. Connections. The rear connection shall accept 12-strand multi-fiber push-on (MPO) connectors . Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber.
- C. Polarity. Provide type universal polarity cassettes.

2.4 FIBER OPTIC SPLICE CASSETTES.

Fiber optic splice cassettes are used in backbone structured cabling connecting the Entrance Rooms to the Main Distribution Areas (MDAs) in the computer room, and the MDAs to Telecommunications Rooms (TRs) where field-terminated (fusion spliced) cable is used.

- A. Form Factor. Designed to install in rack-mounted fiber optic distribution cabinet.
- B. Connections. Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber pairs .
- C. Design. Splice cassette modules shall be self-contained to integrate fiber adapter bulkhead and splice holders. No additional splice trays shall be necessary. Each module shall provide 12 fiber splice connections.
- D. Fiber Type. Provide multimode OM4 and single-mode OS2 splice cassettes as required by the quantity of each type of fiber installed.

2.5 HORIZONTAL CABLE MANAGERS.

- A. Form Factor. 2U, 19" rack-mountable.
- B. Door. Horizontal cable managers shall have a double-hinged front cover to protect installed cables.

2.6 BLANKING PANELS.

- A. Form Factor. 2U, 19" rack-mountable, flat.
- C. Quantity. Provide blanking panels to fill 75% of all RUs in all server cabinets and network cabinets.

PART 3 - EXECUTION

3.1 INSTALLATION:

Not used.

VA Atlanta TVDD 12 Bed CLC
Contract #36C77622R0059
Carrollton GA 30117

Project #508-349

12-01-22

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SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies power distribution equipment and interconnections supporting equipment deployed in telecommunications spaces (entrance rooms, computer rooms, and telecommunications rooms).

1.2 SUMMARY

Section Includes:

- A. Zone Power Distribution Units (zPDUs).
- B. Rack-Mounted Uninterruptible Power Supply (UPS) Units.
- C. Rack Power Distribution Units (rPDUs).

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK

- A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. IT equipment enclosures: Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

1.5 SUBMITTALS

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.
- B. For each type of product:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for rack-mounted power protection and power strips.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 ZONE POWER DISTRIBUTION UNITS (ZONE PDU)

- A. Provide components from a single manufacturer.
- B. 60 Amp Zone PDU:
 - 1. Description: Zone PDU with A/B redundant 3-phase 60A input

circuits and three (3) pairs of A/B redundant L21-20R outlets allowing each supported Standard Density (5kW) enclosure to operate at full density rating.

2. Input Connection: Dual 60A three-phase 208V hard-wired, with junction box and five-wire (L+L+L+N+G) DIN copper terminal blocks accommodating 4AWG conductors. Power cord 10' (3m) length.

3. Output Connection: Three (3) pairs of A/B (redundant) L21-20R outlets.

4. Power Capacity: 43.2kW (21.6kW redundant at full load); 5.7kW fully-rated at each L21-20R outlet.

5. Enclosure: Fully self-contained.

6. Mounting: 1" rack-mount.

C. 30 Amp Zone PDU:

1. Description: Zone PDU with A/B redundant 3-phase 30A input circuits and two (2) pairs of A/B redundant L21-20R outlets allowing each supported Standard Density (5kW) enclosure to operate at partial density rating.

2. Input Connection: Dual 30A three-phase 208V L21-30P. Power cord 10' (3m) length.

3. Output Connection: Two (2) pairs of A/B (redundant) L21-20P outlets.

4. Power Capacity: 21.6kW (10.8kW redundant at full load); combined 8.6kW rated output through each A/B pair of L21-20R outlets.

5. Enclosure: Fully self-contained.

6. Mounting: 1" rack-mount.

2.2 RACK-MOUNTED UNINTERRUPTIBLE POWER SUPPLY (UPS) UNITS

A. Provide components from a single manufacturer.

B. Description: 5kW three-phase 208V 20A rack-mounted UPS with L21-20 input and output connections.

C. Input Connection: Single input NEMA L21-20P plug (twistlock three-phase five wire L+L+L+N+G). Power cord minimum 3' (1m) length.

D. Output Connection: Single output NEMA L21-20R receptacle.

E. Power Capacity: 5kW

F. Enclosure: Fully self-contained.

- G. Mounting: 19" rack mount.
- H. Battery Capacity: Ten minutes at 70% load (3.5kW).
- I. Cooling: Fan-cooled, front air entry, rear exhaust.

2.3 RACK POWER DISTRIBUTION UNITS (RACK PDUS)

- A. Provide components from a single manufacturer.
- B. Description: Metered/monitored three-phase 208V 20A vertical Rack Power Distribution Unit (Rack PDU), 5.7kW, with IEC60320 outlets.
- C. Input Connection: Single input NEMA L21-20P plug (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length.
- D. Output Connections.
 - 1. For Computer Room applications: Minimum 30 each C13 and 6 each C19. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank.
 - 2. For Telecommunications Room (TR) and entrance room applications: Minimum 30 each C13, 6 each C19, 2 each L5-20. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank.
- E. Power Capacity: 5.7kW rated.
- F. Enclosure: Fully self-contained.
- G. Mounting: Toolless mounting, orientation vertical at rear of enclosure, taking up zero RU spaces. Up to two Rack PDUs must be able to be installed on each side for High Density (10kW) enclosures.
- H. Mounting Hardware: As required to connect to the specific enclosure make/model.
- I. Number of RPDUs: 2 for Standard Density (up to 5kW) enclosures, 4 for High Density (10kW) enclosures.
- J. Metering: Local display provides input line currents (Amperage). Additional metering items (voltage, power, energy, power factor) across the unit or at individual outlets, is acceptable.
- K. Monitoring: RJ45 Ethernet port allows connection to an external monitoring system. Supports SNMP v3 with SSL Encryption.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. DEFINITION: Sides (left/right) of the enclosure are as when

viewed from the rear (hot aisle) of the enclosure for the purposes of this section.

B. Zone PDUs.

1. Install Zone PDUs only in enclosures that require them.
2. Zone PDUs shall not be installed in enclosures supported by busbar power distribution.
3. Install Zone PDUs beginning in RU position 1 or the first open RU position above any rack-mounted UPS unit, at the bottom of the 19" rack, on the rear rails of the enclosure.
4. Connect the Zone PDU power cords to the upstream branch circuit supporting the enclosures.

C. Rack-Mounted UPS Units.

1. Install rack-mounted UPS units only in enclosures that require them. Rack-mounted UPS units shall not be installed downstream of another UPS system (cascaded).
2. Where non-redundant UPS power is required to support the enclosure, install the rack-mounted UPS unit in the A side power distribution.
3. Install rack-mounted UPS units beginning in RU position 1, at the bottom of the 19" rack, with the exhaust ports facing the rear of the enclosure. No other equipment should be installed below the rack-mounted UPS units.
4. Connect the rack-mounted UPS unit power cord to the appropriate (A side) power receptacle on the upstream Zone PDU.

D. Rack PDUs.

1. Install Rack PDUs in matched A/B pairs only.
2. Install A side Rack PDUs on the left side of the enclosure and B side Rack PDUs on the right side of the enclosure, interior to the rear enclosure door.
3. Connect the Rack PDU power cord to the upstream rack-mounted UPS unit (where present) or the appropriate power receptacle on the upstream Zone PDU.

- - - E N D - - -

SECTION 27 13 23.13
COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for terminations of fiber optic cabling.

1.2 SUMMARY

Section Includes:

A. Termination Requirements.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

B. Fiber optic cabling requirements: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TERMINATION REQUIREMENTS.

A. Terminate fiber optic cabling with duplex Lucent connector (LC) adapters as required for the application.

B. Pre-terminated connections are preferred for computer room structured cabling applications. Field termination (fusion splicing) for non-computer room applications where cable lengths cannot be determined in advance is acceptable.

- - - E N D - - -

SECTION 27 13 23
COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications optical fiber backbone cabling.

1.2 SUMMARY

Section Includes:

- A. Multimode Optical Fiber Backbone Cables.
- B. Single Mode Optical Fiber Backbone Cables.
- C. Hybrid Optical Fiber Backbone Cables.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.
- B. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.
- B. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 MULTIMODE OPTICAL FIBER BACKBONE CABLES.

Multimode fiber optic backbone cables are specified for inside plant use, for data center backbone use as well as for intrabuilding campus backbone.

- A. Performance Category. Laser-optimized OM4 or OM5 cables are specified.
- B. Testing. All fiber optic backbone media shall pass all Tier 1 requirements (attenuation with an Optical Loss Test Set or OLTS, verification of cable length and polarity) and all Tier 2 requirements (characterization by an Optical Time Domain Reflectometer or OTDR resulting in indication of the uniformity of cable attenuation and connector insertion loss).
- C. Termination. For computer room first level backbone usage, factory pre-terminated cables with MPO connectors are required. Fiber will be field

terminated (fusion spliced) when used to connect the computer room to Telecommunications Rooms (TRs) and other telecommunications spaces.

1. Polarity. For pre-terminated MPO-MPO cables, the polarity of the cables shall be matched to the type of fiber optic distribution cassettes specified.

D. Jacket Color.

1. OM4. Aqua.
2. OM5. Lime.

E. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

F. Bundling and Construction. Bundles consisting of multiples of sub-bundles (subunits) of 12 strands of fiber are specified. Cables shall be dielectric and tight-buffered. Construction shall match the rear entry requirements of the fiber optic distribution or splice cassette such that the sub-bundle (subunit) remains jacketed into the cassette.

G. Length. Backbone cabling for computer room first level backbone use (pre-terminated) shall be procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.

2.2 SINGLE MODE OPTICAL FIBER BACKBONE CABLES.

Single mode fiber optic backbone cables are specified for inside and outside plant use, for campus backbone (interbuilding and intrabuilding) use.

A. Performance Category. OS1 is specified for inside plant applications. Inside/outside rated OS2 is specified for applications where the pathway transits an outside plant path.

B. Testing. All fiber optic backbone media shall pass all Tier 1 requirements (attenuation with an Optical Loss Test Set or OLTS, verification of cable length and polarity) and all Tier 2 requirements (characterization by an Optical Time Domain Reflectometer or OTDR resulting in indication of the uniformity of cable attenuation and connector insertion loss).

C. Termination. Fiber will be field terminated (fusion spliced) when used to connect the computer room to Telecommunications Rooms (TRs) and other telecommunications spaces.

D. Jacket Color. Yellow.

E. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

F. Bundling and Construction. Bundles consisting of multiples of sub-bundles (subunits) of 12 strands of fiber are specified. Cables shall be dielectric and tight-buffered for OS1, and loose-tube gel-filled for OS2.

2.3 HYBRID OPTICAL FIBER BACKBONE CABLES.

Hybrid cables containing multiple 12-strand bundles (subunits) of multimode and/or single mode fiber are acceptable.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. A. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

B. Interior to telecommunications spaces, install fiber optic backbone cabling in overhead cable tray and fiber raceway systems.

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**SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications copper (UTP) horizontal distribution cabling outside of the computer room. For copper (UTP) horizontal cabling in structured cabling systems in the computer room, see Section 27 13 13 Communications Copper Backbone Cabling.

1.2 SUMMARY

Section Includes:

- A. Copper (UTP) Horizontal Cables.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.
- B. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.
- B. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COPPER (UTP) HORIZONTAL CABLES.

Copper (UTP) horizontal cables connect the Telecommunications Room (TR) to each end-user Work Area Outlet (WAO) (horizontal distribution).

- A. Performance Category. Copper (UTP) horizontal cables shall meet the Category 6A performance requirements. Category 6A connectors are required.
- B. Performance Specifications. Meets or exceeds TIA-EIA-568-C.2-10 and TSB-155.
- C. Limited Power (LP) Certification. UL Listed as x-LP (0.5A).
- D. Termination. Field terminated TIA 568B.
- E. Testing. Following installation, each cable shall be field certified to meet performance category requirements per TIA 568-C.2.

F. Conductor Size. 22-24AWG.

G. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

H. Construction. Copper Clad Aluminum (CCA) cable is not permitted.

J. Length. The maximum distance for UTP horizontal cables is limited to 295 feet.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

- A. A. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.
- B. Interior to the TR, install horizontal copper (UTP) structured cabling in overhead cable tray.

- - - E N D - - -

SECTION 27 16 19
COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications patch cords.

1.2 SUMMARY

Section Includes:

- A. Copper (UTP) Patch Cables.
- B. Fiber Optic Patch Cables.

1.3 REFERENCES

- A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

- A. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.
- B. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COPPER (UTP) PATCH CABLES.

- A. Performance Category. Patch cables shall meet the Category 6A performance requirements. Category 6A connectors are required.
- B. Termination Method. Factory pre-terminated TIA 568B.
- C. Conductor Size. 22-28AWG. Where 28AWG patch cords are specified, the overall horizontal channel distance is reduced.
- D. Length. Patch cords of the shortest appropriate length shall be used.

2.2 FIBER OPTIC PATCH CABLES.

- A. Construction. Fiber patch cords shall be constructed of pairs (2-strands) of multimode laser-enhanced 50/125µm fiber.
- B. Performance Category. Multimode patch cords shall meet the OM4performance requirements.

12-01-22

C. Connectors. Duplex Lucent connector (LC) connectors are required. Where polarity requirements are not known, reversible polarity duplex LC connectors are specified on one end.

D. Termination Method. Factory pre-terminated.

E. Length. Patch cords of the shortest appropriate length shall be used.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. Patch cords shall not be used to connect equipment in different server cabinets.

B. Patch cords shall be neatly installed using cable management equipment and following cable management principles.

C. Upon installation patch cords shall be labeled in accordance with the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

- - - E N D - - -

SECTION 27 51 16
PUBLIC ADDRESS AND MASS NOTIFICATION 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 Public Address System (PAS) and associated equipment (here-in-after referred to as the System) in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting PAS 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 0050P3B) 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, and tested, 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 PM, RE and TVE-0050P3B. The VA COR is the only approving authority for other amendments to this document that may be granted, on a case by case basis, in writhing with technical

concurrencies by VA's RE, TVE-0050P3B 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 attesting this requirement as a part of the technical submittal that includes each name and certification, including the OEMs.

1.2 RELATED SECTIONS

- A. 01 33 23 - Shop Drawings, Product Data and Samples.
- B. 07 84 00 - Firestopping.
- C. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- D. 26 41 00 - Facility Lightning Protection.
- 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 - Structured Cabling.

1.3 DEFINITIONS

- 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 Technical Review, for National and VA communications and security, codes, frequency licensing, standards, guidelines compliance:
 - Office of Telecommunications
 - Special Communications Team (0050P2B)
 - 1335 East West Highway - 3rd Floor
 - Silver Spring, Maryland 20910
 - (O) 301-734-0350, (F) 301-734-0360

E. Engineer: Charlotte Engineers LLP
5838 Monroe Rd
Charlotte, North Carolina 28212
(O) 704-531-3000

F. Owner: VAMC

G. General Contractor (GC): (contractor to provide information here)

H. Contractor: Radio 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.
 - d) Form 854 - Antenna Structure Registration.
- 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 c's, for complete list, contact (http://www.osha.gov/dts/otpc/nrtl/fag_nrtl.html):
- 1) UL:
- a) 44-02 - Standard for Thermoset-Insulated Wires and is **OIT room 109**,b) 65 - Standard for Wired Cabinets.
 - c) 83-03 - Standard for Thermoplastic-Insulated Wires and Cables.
 - d) 467-01 - Standard for Electrical Grounding and Bonding Equipment
 - e) 468 - Standard for Grounding and Bonding Equipment.
 - f) 486A-01 - Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - g) 486C-02 - Standard for Splicing Wire Connectors.
 - h) 486D-02 - Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
 - i) 486E-00 - Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
 - j) 493-01 - Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.

- k) 514B-02 - Standard for Fittings for Cable and Conduit.
- l) 1069 - Hospital Signaling and Nurse Call Equipment.
- m) 1333 - Vertical (Riser) Fire Rating.
- n) 1449 - Standard for Transient Voltage Surge Suppressors.
- o) 1479-03 - Standard for Fire Tests of Through-Penetration Fire Stops.
- p) 1863 - Standard for Safety, Communications Circuits Accessories.
- q) 2024 - Standard for Optical Fiber Raceways.
- r) 60950-1/2 - Information Technology Equipment - Safety.
- 2) Canadian Standards Association (CSA): same tests as for UL.
- 3) Communications Certifications Laboratory (CCL): same tests as for UL.
- 4) Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.
- b) Subpart 35 - Compliance with NFPA 101 - Life Safety Code.
- c) Subpart 36 - Design and construction requirements for exit routes.
- d) Subpart 268 - Telecommunications.
- e) Subpart 305 - Wiring methods, components, and equipment for general use.
- 5) 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 Circulars for Construction of Antenna Towers.
 - b) Forms 7450 and 7460-2 - Antenna Construction Registration.
- 6) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:
 - a) Office of Telecommunications:
 - 1) Handbook 6100 - Telecommunications.
 - a) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.

- b) Special Communications Proof of Performance Testing,
VACO Compliance and Life Safety Certification(s).
- b) Office of Cyber and Information Security (OCIS):
 - 1) Handbook 6500 - Information Security Program.
 - 2) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
- c) 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.
- d) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
- e) Office of Construction and Facilities Management (CFM):
 - 1) Master Construction Specifications (PG-18-1).
 - 2) Standard Detail and CAD Standards (PG-18-4).
 - 3) Equipment Guide List (PG-18-5).
 - 4) Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.
 - 5) Minimum Requirements of A/E Submissions (PG 18-15):
 - a) Volume B, Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B.
 - b) Volume C - Minor and NRM Projects, Article III, Paragraph S.
 - c) Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
 - 6) Mission Critical Facilities Design Manual (Final Draft - 2007).
 - 7) Life Safety Protected Design Manual (Final Draft - 2007).
 - 8) 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).
- 2. United States 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 160-51 - Sound systems.
 - 7) RS 270 - Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.
 - 8) SE 101-A49 - Amplifier for Sound Equipment
 - 9) SE 103-49 - Speakers for Sound Equipment
- 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.
 - 3) 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) 1600 - Disaster Management, Chapter 5.9 - Communications and Warning

3. State Hospital Code(s).

4. Local Town, City and/or County Codes.

5. 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 systems of comparable size and 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 PA 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 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.
- C. The Contractor shall display all applicable national, state and local licenses and permits.

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

(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.)

- A. 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.
- B. 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.
- C. 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-0050P3B) will not review any submittal that does not have this list.
- D. 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).
- E. 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 Telecommunications Infrastructure Plant (TIP) interface distribution layout drawing, as they are to be installed and interconnected to teach other (REFER TO APPENDIX B - SUGGESTED TELECOMMUNI-CAITONS ONE LINE TOPOLOGY pull-out drawing).
- F. Headend and each interface distribution cabinet layout drawing, as they are expected to be installed.
- G. Equipment OEM 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 survey(s) that depict various system features and capacities required in addition to the on-site survey requirements described herein. 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. PA Cable System Design Plan:

1) An OEM and contractor designed functioning PA 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 PA: 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 PA cable and accessory requirements and engineer a functioning PA distribution system and equipment requirement plan of the following paragraph(s), at a minimum:

2) The required PA Equipment Locations:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Master Control Stations		
Telephone Operators Room		
Police Control Room		
Other		
Zone Amplifiers		
All Call (complete Zone 1)		
Speakers		
Overhead		
Locations		
Other		
Other		
Power Supply(s)		

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Location		
Other		
UPS (s)		
Location		
Other		
Maintenance/Programming Console		
Location(s)		
Other		

3) The required PA Cable Plant/Connections:

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:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS (s)		
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified herein		
Speaker Locations		
Remote Locations		
Telephone Operator Room		
Police Control Room		
Other		
Maintenance/Program Console		
Location(s)		
Other		
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 floor plans shall be marked in pen to include the following:
 - 1. All device locations with UL labels affixed.
 - 2. Conduit locations.
 - 3. Head-end equipment and specific location.
 - 4. Each interface and equipment specific location.
 - 5. Facility Entrance (aka DEMARC) Room(s) interface equipment and location(s).
 - 6. Telephone Equipment Room (TER) interface equipment and specific location.
 - 7. Main Computer Room (MCR) interface equipment and specific location.
 - 8. Police Control Room (PCR) interface equipment and specific location.
 - 9. Engineering Control Room (ECR) interface equipment and specific location
 - 10. Telecommunication Outlet (s -TCO) equipment and specific location
 - 11. TIP Wiring diagram(s).
 - 12. Warranty certificate.
 - 13. System test results.
 - 14. System Completion Document(s) or MOU.

1.10 WARRANTIES

- A. The Contractor shall warrant the systems to be free from defect in material 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. Warranty certificate.
 - 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.
- 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

2.0 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 PA: Central Control Cabinet is **OIT room 109**, Power Supply is **OIT room 109**, UPS i **OIT room 109,,** Two (2) Remote Annunciation Consoles is **ENTRANCES**, Main Equipment Cabinet is is **OIT room 109**, Speaker is **CORRIDORS**.

- C. Coordinate features and select interface components to form an integrated PA system. Match components and interconnections between the systems for optimum performance of specified functions.
- D. Expansion Capability: The PA 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.
- F. Meet all FCC requirements regarding 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 National Recognized Testing Laboratory (NRTL - i.e. UL) for duty outdoors or in damp locations.
- H. Deliver a fully functioning and operable PA in the specific locations shown on the drawings.

2.1 SYSTEM DESCRIPTION

- A. Furnish and install a complete and fully functional and operable HF Radio System. Provide additional require conduit(s) according to Specification 27 11 00.
- B. The Contractor is responsible for interfacing the [Nurse Call](#) systems with the System and shall be the interface points for connection of the radio interface cabling from the interface unit(s). The interface unit(s) shall be provided by the Contractor.
- C. 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 total PA system shall be configured and installed so that the combination of equipment actually employed does not produce any undesirable visual or aural effects such as signal distortions, noise pulses, glitches, hum, transients, images, etc. The

interface points must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.

- D. It is not acceptable to utilize the telephone cable system for the control of radio signals and equipment. The System Contractor shall connect the Telephone System Remote Control System to the Radio System Paging Control Unit 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. The Owner shall arrange for the interconnection between the PA and Telephone Systems with the appropriate responsible parties.
- E. System hardware shall consist of a **standalone (separate)** PA communications network comprised of amplifiers, mixers, speakers, volume controls, test sets, telephone private branch exchange (PBX) interface equipment, equipment cabinets/racks, wiring and other options such as, sub zoning in addition to "all call" functions, computer interfaces, printer interfaces and wireless network interfaces, (**when specifically approved by 005OP3B and VA Headquarters Spectrum Management 005OP2B - herein after referred to as 005OP2B**) 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/patient communications network.
- F. Systems 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 005OP3B).
- G. The PA Head End Equipment shall be located in Telecommunications **room OIT C225**. The PA shall cover floor **2 and areas as shown in plans**. The PA shall provide zoned, one-way voice paging through distributed, ceiling mounted loudspeakers. Voice input into the PA shall be by zone using the telephone system. **The Nurse Call / Code Blue System may**

interface the PA system when specifically approved by VA Headquarters 0050P3B during the project approval process prior to contract bidding.

- H. 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 24 hours.
- I. Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT, LCD 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 two (2) Hours.
- J. The System is defined as Emergency 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 where each enunciation point shall fully function independent of the Facility's PBX.**
 - 1. These two (2) additional remote locations shall be fully manned:
 - a. 24/7/365 for certified Hospital **Clinics**.
 - b. As long as other identified VA Medical / Servicing Facilities are open for servicing patients.
 - c. 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 - 0050P3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
 - d. One (1) global (aka "all call") hard wired zone shall be provided that connects to every system speaker.
 - e. There shall be hard-wired sub-zones designated as follows:
 - 1) Each zone shall be capable of be programmed.
 - 2) The System shall have a minimum of three (3), unused zones.
 - 2. The System shall allow voice pages to be made within a single zone, across programmed multiple zones or a global page (all zones) by using preset codes entered into the keypad of any telephone instrument attached to the PBX.

- K. The System shall interface with the Facility's existing PAS so that a global page (aka "all call" page) is communicated to the existing PAS and the new System of this project. Arrangements for interconnection of the System and the telephone system(s) shall be coordinated with the owner and the PBX provider.
- L. The system shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. light bulbs, wires, contact switch connections, master control stations, wall stations, 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 main supervisory panel, nurse control station and all remote amplifier locations.
- M. When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Nurse Call, radio paging, wireless systems, etc) the connection point shall be at one location and shall meet the following minimum requirements for each hard wired connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS 0050P3B AND 0050P2B):
 - 1. UL 60950-1/2.
 - 2. FIPS 142.
 - 3. FCC Part 15 Listed Radio Equipment is not allowed.
- N. All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with screw type audio connectors.
- O. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cycolac plastic for the areas where provided.
- P. All trunk, branch, and interconnecting cables and unused equipment ports or taps shall be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.
- Q. 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.

- R. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines 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.
- S. 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.
- T. 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.

2.2 SYSTEM PERFORMANCE:

- A. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the Facility's PA system voice and data service as follows:
1. 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, interconnection and terminating locations in the TERs.
 2. Audio Input: The signal level of each audio input channel at each input point shall be a MINIMUM of zero decibels measured (dBm), +0.10 dBm across 150 Ohms, balanced.
 3. Audio Output: The audio signal level at each speaker shall be a MINIMUM of +0.25 Watt (W) and a maximum of +20 W, 600 Ohms balanced impedance, on a 70.7 V audio distribution line Contractor to determine and set each speaker's proper audio signal level (top) based on speaker location and the ambient noise level in speaker coverage area.
 4. The system shall meet the following MINIMUM parameters at each speaker:
 - a. Cross Modulation: -46 dB
 - b. Hum Modulation: -55 dB
 - c. Isolation (outlet-outlet): 24 dB
 - d. Impedance:
 - 1) Distribution: 600 Ohm balanced @ 70.7 V audio line level.
 - 2) Speaker: Selectable, as required.
 - e. Audio Gain: 10 dB minimum @ mid-range measured with a sound pressure level meter (SPL)
 - f. Signal to noise (S/N) ratio: 35 dB, minimum
- B. Audio Level Processing: The head-end 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 zone or sub-zone in the system and distribute them into the system's distribution trunks. It is acceptable to use identified telephone system cable pairs designated for PA use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor.

1. THE USE OF TELEPHONE CABLE TO DISTRIBUTE PA SIGNALS CARRYING AC OR DC VOLTAGE IS NOT ACCEPTABLE AND WILL NOT BE APPROVED.
2. Additionally, each remote location shall be provided with the equipment required to ensure the system supervision and designed audio channel capacity at each speaker identified on the contract drawings.

2.3 MANUFACTURERS

- A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM 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 (IFB).
- 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 an Emergency performing Public Safety Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Public and 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 nationally recognized testing laboratory (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. Each cabinet shall be provided with internal and external items to maintain a neat and orderly system of equipment, wire, cable and conduit connections and routing.
3. 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.
 - b. The following equipment items are the minimum requirements of VA to provide an acceptable system described herein:

CONTRACTOR NOTE: Select the required equipment items quantities that will satisfy the needs of the system and edit

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>
1.	As required	Interface Panel(s)
1.a	As required	Electrical Supervision
		Trouble Enunciator
1.a.1.	As required	Equipment Back Box(s)

1.a.2.	As required	Telephone Access Equipment
1.a.3.	As required	Radio Paging Access Equipment
1.a.3.a.	As required	Radio Pager Equipment
1.a.4.	As required	Wireless Access Equipment
1.a.5.	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.3.a	As required	Main Power Amplifiers
3.a.3.b	As required	Remote Power Amplifiers
3.a.3.c	As required	Distributed Amplifiers (When Approved)
3.a.4.	As required	Interconnecting wire Cable(s)
3.a.4.a	As required	Wire Cable Connector(s)
3.a.4.b	As required	Wire Cable Terminator(s)
3.a.4.c	As required	Wire Management System
3.b.	As required	Head End Function(s)
4.	As required	Distribution System(s)
4.a	As required	Equipment Back Box(s)
4.a.1.	As required	Speakers
4.a.1.a	As required	Overhead
4.a.1.b	As required	Horn
4.a.1.c	As required	Outside
4.a.1.d	As required	Speaker w/ Microphone
5.	2 (MIN)	Remote Station(s)
5.a.	As required	Spare Items
6.	As required	Mental Health Unit
6.a.	As required	Interface Panel(s)
6.b.	As required	Electrical Supervision
	Trouble Enunciator	
6.c.	As required	Equipment Back Box(s)
6.d.	As required	Telephone Access Equipment
6.e.	As required	Radio Paging Access Equipment
6.e.1.	As required	Radio Pager Equipment
6.f.	As required	Wireless Access Equipment
6.g.	As required	Personal Communicator quipment
6.h.	As required	Lightning Arrestor
6.i.	As required	Head End Equipment
	Location(s)	
6.i.1.	As required	Cabinets
6.i.2.	As required	AC Power Conditioner & Filter
6.i.3.	As required	AC Power Strip
6.i.4.	As required	UPS
6.i.5.	As required	Main Power Amplifiers
6.j.	As required	Remote Power Amplifiers
6.k.	As required	Distributed Amplifiers (When Approved)
6.l.	As required	Interconnecting Wire Cable(s)
6.l.1.	As required	Wire Cable Connector(s)
6.l.2.	As required	Wire Cable Terminator(s)
6.l.3.	As required	Wire Management System

6.m.	As required	Head End Function(s)
6.n.	As required	Distribution System(s)
6.n.1	As required	Equipment Back Box(S)
6.n.2	As required	Speakers
6.n.2(a)	As required	Overhead
6.n.2(b)	As required	Horn
6.n.2(c)	As required	Outside
6.n.2(d)	As required	Speaker w/ Microphone
6.o	2 (MIN)	Remote Station(s)
6.p.	As required	Spare Items
7.a	As required	Interface Panel(s)
7.b	As required	Electrical Supervision
		Trouble Enunciator
7.c	As required	Equipment Back Box(s)
7.d.	As required	Telephone Access Equipment
7.e.	As required	Radio Paging Access Equipment
7.e.1.	As required	Radio Pager Equipment
7.f.	As required	Wireless Access Equipment
7.g.	As required	Personal. Communicator
		Equipment
7.h.	As required	Lightning Arrestor
7.i.	As required	Head End Equipment
		Location(s)
7.i.1.	As required	Cabinets
7.i.2.	As required	AC Power Conditioner & Filter
7.i.3.	As required	AC Power Strip
7.i.4.	As required	UPS
7.i.5.	As required	Main Power Amplifiers
7.j.	As required	Remote Power Amplifiers
7.k.	As required	Distributed Amplifiers (When
		Approved)
7.l.	As required	Interconnecting Wire Cable(s)
7.l.1.	As required	Wire Cable Connector(s)
7.l.2.	As required	Wire Cable Terminator(s)
7.l.3.	As required	Wire Management System
7.k.	As required	Head End Function(s)
7.m.	As required	Distribution System(s)
7.m.1.	As required	Equipment Back Box(s)
7.m.2.	As required	Speakers
7.m.2(a)	As required	Overhead
7.m.2(b)	As required	Horn
7.m.2(c)	As required	Outside
7.m.2(d)	As required	Speaker w/ Microphone
7.n.	2 (MIN)	Remote Station(s)
7.o.	As required	Spare Items

Rehabilitation Unit EXCEPT it does contains a CODE BLUE Function.
 If these units are provided
 as a part of the project, AT
 A MINIMUM - DUPLI-CATE THE
 BLINE REHABILITATION UNIT'S
 EQUIPMETN LISTE AND EDIT AND
 RENUMBER ACCORD-INGLY)

B. ENT (aka DEMARC) 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, TCR, TR, SCC, PCR, STR, HER Rooms and Equipment:

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.

1. Interface Equipment:

a. TER:

1) Paging adaptor:

- a) The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility's telephone system with the Facility Telephone Contractor or local telephone company (AVL-SP).
- b) The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility's Telephone Contractor. The Paging Adapter shall:
 - 1) Monitor each audio input and output on the unit.
 - 2) Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.
 - 3) Be provided as part of the head end equipment and shall be located in the Telephone Switch Room
 - 4) Be provided with Executive (aka emergency) Paging Override of all routine paging calls in progress or being accessed to allow system "all call" (aka global) and radio paging calls designated as (Code One Blue) functions.
 - 5) Be capable of internal time out capability.
 - 6) Function completely with the interface module.
 - 7) Provide one spare adapter.

- c) Time Out Device: A time out device/capability shall be provided to prevent system "hang-up" due to an off-hook telephone. The device shall be able to be preset from 30 seconds to two (2) minutes. Its function shall not interfere with or override the required "all call" (aka global) operational capability.
 - 1) Central Processor Module:
 - 2) Controls system operations and holds all programmed parameters.
 - 3) Data link connection to additional CPU modules.
- d) Power Module: Provides 12V DC @ 800mA to Central Processor Module.
- e) Minimum three (3) Zone Module:
 - 1) Provides a minimum of three (3) paging zone outputs at 70V audio sound level.
 - 2) Background Music inhibit switch for each zone.
- 2) Audio Monitor Panel:
 - a) The panel shall be EIA/TIA standard for 483 mm (19") cabinet mounting.
 - b) It shall be provided in the upper portion of the head-end equipment cabinet.
 - c) Provide one (1) spare panel.
- 3) Trouble Annunciator Panel:
 - a) A trouble annunciator panel shall be provided in the head-end cabinet, and at locations as designated on the contract drawings. The panel(s) shall be compatible with or generate electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end audio power amplifier(s), remote power amplifier(s), microphone consoles and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects an amplifier or trunk-line is malfunctioning.
 - b) Provide one (1) spare panel.
- 4) Head-End Equipment
 - a) Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices

necessary to form a complete system listed herein. Head-end components may be rack mounted or wall mounted in a metal enclosure.

- b) Provide the head end equipment in the closed telecommunications closet where the PA system is installed to include the minimum equipment listed herein.
 - c) Provide minimum of 30 minute battery back-up to system components.
- 5) 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
- a) Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet):
 - b) 74" (48RU) rack space, Welded Steel construction, Minimum 20" usable depth, Adjustable front mounting rails.
 - 1) Install the following products in rack provided by same manufacturer or as specified:
 - 2) Security screws w/ nylon isolation bushings.
 - 3) Textured blank panels.
 - 4) Custom mounts for components without rack mount kits.
 - 5) Security covers.
 - 6) Copper Bus Bar.
 - 7) Power Sequencer rack mounted power conditioner and (provide as needed) delayed sequencer(s) with two (2) inswitched outlets each and contact closure control inputs.
 - 8) Rack mounting: Provide rack mount kit.
- 6) Amplifier Equipment:
- a) Paging (aka zone):
 - 1) Inputs for 600-ohm balanced telephone line, LO-Z balanced microphone, and background music.
 - 2) Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full rated output with sound-pressure level of less than 10

dynes/sq. cm impinging on master stations speaker microphones, or handset transmitters

- 3) Automatic Level Control (ALC) for pages, adjustable background music muting level during page, wall or rack mountable.
 - 4) 16-ohm, 25V, 25V center tapped (CT), and 70V outputs. Amplifier quantity and size (output power) as needed. Continuous amplifier power rating shall exceed loudspeaker load on amplifier by at least 25%.
 - 5) Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
 - 6) Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
 - 7) Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
 - 8) Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.
 - b) Output Regulation: Maintains output level within 2 dB from full to no load.
 - c) Amplifier Protection: Prevents damage from shorted or open output.
 - d) Be provided with electronic supervision function(s).
 - e) Provide one spare amplifier.
- b. TCR:
- 1) Microphone Paging Console:
 - a) A console shall be provided as shown on the drawings.
 - b) The console shall contain visual enunciators for each connection to the telephone system's Public Address Paging Adapter. The visual enunciators shall display all the System connections to the telephone system being used.
 - c) The console shall be fully independent of the Facility's telephone system so if the telephone system has a catastrophic failure (aka partial, multiple or total system failure) the microphone console will function normally as if the Facility's telephone system was operating normally.

The restoration of the Facility's telephone system shall not affect the System.

d) Each microphone console shall:

- 1) Be Mounted: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
- 2) Have a Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
- 3) Have a system interface Back Box: Minimum Two-gang galvanized steel with 2-1/2 inch minimum depth.
- 4) Have an Internal Speaker: 3 inches, 2.3 oz. minimum; permanent magnet.
- 5) Have a Call Switch: Mount on faceplate. Permits calls to The system.
- 6) When approved - in lieu of a standalone microphone, provide a Handset with Hook Switch: Have a Handset with Hook Switch: Telephone type with 24-inch-long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- 7) Be provided with an electrical supervision panel to provide both audio and visual trouble alarms to the Nurse Call /Code Blue electrical supervision system.
- 8) Be capable of internal time out capability.
- 0) Be completely compatible with the Telephone Interface unit(s)

2) Electrical Supervision Trouble Annunciator Panel:

- a) The Electrical Supervision Trouble Annunciation Panel shall be located in the TCR and PCR's SCC.
- b) The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the PA system head-end processing equipment, local/remote control consoles, 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 trouble or trunk-line is malfunctioning.

- c) TRs: Locate the PA floor distribution equipment within each TR as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.
- 1) General Equipment: Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system listed herein. Equipment components may be rack mounted or wall mounted in a metal enclosure.
- 2) Amplifiers:
 - a) Panging Amplifier Equipment:
 - b) Refer to the Amplifier characteristics described herein Paragraph 2.4.G.f.
 - c) Provide one (1) spare amplifier in addition to the spare Head End Amplifier.
- 3) Distributed Amplifier:
 - a) Provide the type and number of the amplifier(S) required to meet the system design. Provide this unit as complete and separate technical submittal during the IFB review portion of the project.
 - b) Provide one spare amplifier for each 20% (or portion thereof) of amplifiers used in the system.
- 4) Provide the equipment in the nearest TER where the System is installed to include the minimum equipment listed herein.
- 5) Provide minimum of 30 minute battery (UPS) back-up to system components.
- 6) Equipment Cabinet: Comply with cabinet requirements as aforementioned.
- 7) Trouble Annunciator Panel: Comply with the panel characteristics identified herein.
- d. SCC, PCR, STR, HER: Refer to PG-18-10, Article 7 for specific required equipment and use minimum aforementioned specifications for population.

D. TIP DISTRIBUTION SYSTEM:

- 1. System Speakers:
 - a. Ceiling Cone-Type:
 - 1) Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.

- 2) Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
 - 3) Minimum Dispersion Angle: 100 degrees.
 - 4) Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
 - 5) Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
 - 6) Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum with textured white finish. Completely fill the baffle with fiberglass.
 - 7) Vandal-Proof, High-Strength Baffle: For flush-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
 - 8) Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
 - 9) Have a minimum of two (2) safety wires installed to a solid surface or use a flexible conduit from ceiling / wall back box to the speaker back box.
 - 10) The speakers and mounting shall be self contained and wall mounted with flush back box at a minimum of 10 meter intervals and shall match (or contrast with, at the direction of the RE) the color of the adjacent surfaces.
 - 11) Provide one spare speaker, mount, and back box for each 50 speakers or portion thereof.
- b. Wall Mounted Horne-Type:
- 1) Each horn speaker shall be provided with a means of adjusting the output level over the rated horn speaker range to an appropriate audio level in the area installed.
 - 2) Provide horn speakers in equipment rooms, mechanical room, supply warehouse areas, loading dock, entrance and exit areas, and at other areas as indicated on the drawings.

- 3) Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
 - 4) Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
 - 5) Minimum Power Rating of Driver: 15 W, continuous.
 - 6) Minimum Dispersion Angle: 110 degrees.
 - 7) Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
 - 8) Provide one spare speaker, mount, and back box for each 20 speakers or portion thereof.
- c. System Cables: In addition to the TIP provided under Specification Section 27 15 00 - TIP Horizontal and Vertical Communications Cabling, provide the following additional TIP installation and testing requirements, provide the following minimum System TIP cables & interconnections:
- 1) Line Level Audio and Microphone Cable:
 - a) Line level audio and microphone cable for inside racks and conduit.
 - b) Shielded, twisted pair Minimum 22 American Wire Gauge (AWG), stranded conductors and 24 AWG drain wire with overall jacket.
 - 2) Speaker Level (Audio 70.7Volt [V]) Cable, Riser Rated:
 - a) For use with 70.7 V audio speaker circuits.
 - b) 18 AWG stranded pair, minimum.
 - c) UL-1333 listed.
 - 3) Speaker Level Audio Cable, Plenum Rated (70.7V):
 - a) For use with 70.7 V audio speaker circuits.
 - b) 18 AWG stranded pair, minimum.
 - 4) All cabling shall be **plenum** rated.
 - 5) Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.
2. Raceways, Back Boxes and conduit:
- a. Raceways:
 - 1) 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:

- 2) 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.
- 3) Intercommunication System cable infrastructure: EMT above accessible ceilings, 24 inches on center.
- 4) Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.
- 5) Flexible metal conduit is prohibited unless specifically approved by 0050P3B.

b. 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 (0050P3B).
- 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.

3. Device Back Boxes:

- a. Furnish to the electrical contractor all back boxes required for the PA system devices.
 - b. 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.
4. Telecommunication Outlets (TCO): Populate each TCO that is required to perform system operations in the locations that were provided and cabled as a part of Specifications Sections 27 11 00 and 27 15 00. Provide additional TCO equipment, interfaces and connections as required by System design. Provide secured pathway(s) and TCOs as required.
5. 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 four (4) hours.
 - 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 PA 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).
- E. Patient Bedside Prefabricated Units (PBPU):
 1. Where 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.

F. 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) Coaxial Cable Shields.
 - 2) Control Cable Shields.
 - 3) Data Cable Shields.

- 4) Equipment Racks.
 - 5) Equipment Cabinets.
 - 6) Conduits.
 - 7) Duct.
 - 8) Cable Trays.
 - 9) Power Panels.
 - 10) Connector Panels.
 - 11) Grounding Blocks.
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
 4. 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.
 5. 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.
 6. 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.
 7. 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.
 8. 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 (0050P3B) 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 PA system faceplate and the faceplate opening for the PA system back boxes.
- B. Coordinate with the cabling contractor the location of TIP equipment in the **TER, TCR, PA, PCR, SCC, ECR, STRs, NSs, HER 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. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
 - 3. System components installed by others.
 - 4. 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

Provide a one-on-one meeting with the particular manager of each unit affected by the installation of the new PA 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. Locate overhead ceiling-mounted loudspeakers as shown on drawings, with minor changes not to exceed 12" in any direction.
 - a. Mount transformers securely to speaker brackets or enclosures using screws. Adjust torsion springs as needed to securely support speaker assembly.
 - b. Speaker back boxes shall be completely filled with fiberglass insulation.
 - c. Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.

6. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and 0050P3B.
 7. 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.
 8. 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.
 9. Color code all distribution wiring to conform to the PA 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.
 10. Connect the System's primary input AC power to the Facility's 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.
 11. 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.
 12. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
 13. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.
- 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 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 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 PA, TER, TCR, PCR, SCC, 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 too:

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 abraded during installation. There are no acceptable methods of repairing damaged or abraded 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 ample 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 $\frac{3}{4}$ " 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
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. 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.
16. 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.
17. 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 prevents 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 - 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 too:
- 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 PA 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. SYSTEM 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 PA 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 PA Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
- a. The Contractor shall use 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

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 PA 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 PA 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 - TESTING / TRAINING

4.0 SYSTEM LISTING

The PA System is NFPA listed as an "Emergency / Public Safety" Communications system. Where Code Blue signals are transmitted, that listing is elevated to "Life Support/Safety." Therefore, the following testing provisions are the minimum to be performed and provided by the contractor and OEM.

4.1 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

1. After completion of 25 - 30% the installation of a head end cabinet(s) and equipment, one microphone console, local and remote enunciation stations, two (2) zones, two (2) sub zones prior to any further work, this portion of the system must be pretested, inspected, and certified. 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) 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-0050P3B 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 PA 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 PA 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) Local Control Stations.
 - 3) Zone Equipment/Systems.
 - 4) Sub-Zone Equipment/Systems.
 - 5) Remote Control Panels.
 - a.) TCR.
 - b.) PCR/SCC.
 - 6) All Networked locations.
 - 7) System interface locations (i.e. TELCO, two way radio, etc.).
 - 8) System trouble reporting.
 - 9) System Electrical Supervision.
 - 10) UPS operation.
 - 11) STRs.
 - 12) NSs
 - 13) TCOs.
 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 PA System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 day's written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of TVE 0050P3B and an OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Emergency / Public Safety 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. Retesting of the entire System shall be rescheduled at the convenience of the Government.
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 0050P3B Representative will tour all areas where the PA 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 system head end 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 head end equipment test, each speaker (or on board speaker) shall be inspected 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 speaker in each leg to verify the PA distribution system meets all system performance standards.
- d. If the RED system is a part of the system, each volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).
- e. Additionally, each installed head end equipment, microphone console; amplifier, mixer, distributed speaker/amplifier, monitor speaker, telephone interface, power supply and remote amplifiers shall be checked insuring they meet the requirements of this specification.
- f. 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: "all call," three sub-zoned, minimum of 15 minutes of UPS operation, electrical supervision, trouble panel, corridor speakers and audio paging.
- h. Individual Item Test: The TVE 0050P3B 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. Random Noise Generator.
7. Audio Amplifier with External Speaker.

4.2 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 and will remain so for a period of two (2) years 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. 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.

4.3 TRAINING

A. Provide thorough training of all biomed engineering and electronic technical 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 BME / Electronic 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 Telephone Staff - both day and night shifts.
3. **24** hours for supervisors and system administrators.

- - - E N D - - -

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 0050P3B) 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-0050P3B. 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 writhing with technical concurrencies by VA's PM, RE, TVE-0050P3B 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. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- E. 27 05 11 - Requirements for Communications Installations.
- F. 27 05 26 - Grounding and Bonding for Communications Systems.
- G. 27 05 33 - Conduits and Backboxes for Communications Systems.
- H. 27 10 00 - Structured 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:

Office of Telecommunications
Special Communications Team (07A2)
202-461-5301, 202-461-5311

E. Engineer:

Charlotte Engineers LLP

5838 Monroe Rd

Charlotte, North Carolina 28212

(O) 704-531-3000

F. Owner: VAMC

G. General Contractor (GC): (contractor to fill this out)

H. 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/otpcanrt1/faq_nrt1.html):
 - 1) UL:
 - a) 44-02 - Standard for Thermoset-Insulated Wires and Cables.
 - b) 65 - Standard for Wired Cabinets.
 - c) 83-03 - Standard for Thermoplastic-Insulated Wires and Cables.
 - d) 467-01 - Standard for Electrical Grounding and Bonding Equipment
 - e) 468 - Standard for Grounding and Bonding Equipment.
 - f) 486A-01 - Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - g) 486C-02 - Standard for Splicing Wire Connectors.
 - h) 486D-02 - Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
 - i) 486E-00 - Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
 - j) 493-01 - Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.

- k) 514B-02 - Standard for Fittings for Cable and Conduit.
- l) 1069 - Hospital Signaling and Nurse Call Equipment.
- m) 1449 - Standard for Transient Voltage Surge Suppressors.
- n) 1479-03 - Standard for Fire Tests of Through-Penetration Fire Stops.
- o) 1666 - Standard for Wire/Cable Vertical (Riser) Tray Flame Tests.
- p) 1863 - Standard for Safety, Communications Circuits Accessories.
- q) 2024 - Standard for Optical Fiber Raceways.
- r) 60950-1/2 - Information Technology Equipment - Safety.
- 2) Canadian Standards Association (CSA): same tests as for UL.
- 3) Communications Certifications Laboratory (CCL): same tests as for UL.
- 4) Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.
- b) Subpart 35 - Compliance with NFPA 101 - Life Safety Code.
- c) Subpart 36 - Design and construction requirements for exit routes.
- d) Subpart 268 - Telecommunications.
- e) Subpart 305 - Wiring methods, components, and equipment for general use.
- 5) 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 Circulars for Construction of Antenna Towers.
 - b) Forms 7450 and 7460-2 - Antenna Construction Registration.
- 6) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:
 - a) Office of Telecommunications:
 - 1) Handbook 6100 - Telecommunications.

- a) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.
- b) Special Communications Proof of Performance Testing, VACO Compliance and Life Safety Certification(s).
- b) Office of Cyber and Information Security (OCIS):
 - 1) Handbook 6500 - Information Security Program.
 - 2) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
- c) 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.
- d) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
- e) Office of Construction and Facilities Management (CFM):
 - 1) Master Construction Specifications (PG-18-1).
 - 2) Standard Detail and CAD Standards (PG-18-4).
 - 3) Equipment Guide List (PG-18-5).
 - 4) Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.
 - 5) Minimum Requirements of A/E Submissions (PG 18-15):
 - a) Volume B, Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B.
 - b) Volume C - Minor and NRM Projects, Article III, Paragraph S.
 - c) Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
 - 6) Mission Critical Facilities Design Manual (Final Draft - 2007).
 - 7) Life Safety Protected Design Manual (Final Draft - 2007).
 - 8) 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).
- 2. 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.
 - 3) 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.

3. State Hospital Code(s).

4. Local Town, City and/or County Codes.

5. 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 SUBMITTAL[S])

(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.)

- A. 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.
- B. 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.
- C. 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-0050P3B) will not review any submittal that does not have this list.
- D. 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).
- E. 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 TELECOMMUNI-CAITONS ONE LINE TOPOLOGY pull-out drawing).
- F. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
- G. 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.
- H. 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. New system shall be linked back to tek-tone 120 system. coordinate new connections with equipment vendor prior to purchase. 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:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Master Stations	1	
Dome Lights		
Room	13	
Corridor	7	
Emergency Stations	0	
Operating Rooms	0	
Code Blue	0	
Operating Room	0	
Maintenance/Programming Console	0	
OIT Room	0	

- 3) The required Nurse Call and/or Code Blue Cable Plant/Connections:

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:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		
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		
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

- A. The Contractor shall warrant the systems to be free from defect in material 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

2.0 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 _____, Power Supply is _____, Emergency Station is _____, Dome Light is _____, Code Blue Station is _____,
- 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.

2.1 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 is responsible for interfacing the PA systems with the System.

- C. 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.
- D. 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 PA Systems with the appropriate responsible parties.
- E. System hardware shall consist of a **standalone (separate)** nurse call 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 0050P3B)** 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 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.***
- F. 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 0050P3B)**.
- G. The Nurse Call Head End Equipment shall be located in Telecommunications Room C225. **The Nurse Call / Code Blue System may**

interface the PA system when specifically approved by VA Headquarters TVE 0050P3B during the project approval process prior to contract bidding.

- H. 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.
- I. 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.
- J.
 - 2.
- K. 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.
- L. 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 - 0050P3B AND SPECTRUM MANAGEMENT - 0050P2B - hereinafter referred to as SM - 0050P2B):
 - 1. UL 60950-1/2.
 - 2. FIPS 142.

3. FCC Part 15 Listed Radio Equipment restriction compliance approved by SM - 0050P2B.
- M. 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.
- N. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cycolac plastic for the areas where provided.
- O. 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.
- P. 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.
- R. 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.

S. 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 0050P3B), 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, and

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.

CONTRACTOR NOTE: Select the required equipment items quantities that will satisfy the needs of the system and edit between the // - - //. Do not delete equipment items that are not required - place a "0" in the appropriate Item location. The two color coded sections for the Mental Health and Blind Rehabilitation Units are provided for use when these units are a part of the project. If these units are not a part of the project - retain each unit's heading and place "0" in the respective "as required" column and delete the remaining system items.

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>
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
5.	//As required//	Distribution System(s)
5.a	//As required//	Staff Station
5.a.1	//As required//	Equipment Back Box(s)
5.b	//As required//	Duty Station
5.b.1	//As required//	Equipment Back Box(s)
5.c	//As required//	Code Blue Station
5.c.1	//As required//	Equipment Back Box(s)
5.c.2	2 (MIN)	Remote Station(s)
5.d	//As required//	Patient Station(s)
5.d.1	//As required//	Equipment Back Box(s)
5.d.2	//As required//	Bed Interface(s)
5.d.3	//As required//	Pillow Speaker
5.d.4	//As required//	Push Button Cordset
5.d.5	//As required//	Dummy Plugs
5.d.6	//As required//	Bed Integrated Control
5.d.7	//As required//	Lighting Interface Module
5.d.8	//As required//	TV Control Interface
5.d.9	//As required//	TV Control Jack
5.d.10	//As required//	TV Interconnection Cables
5.d.11	//As required//	HDTV Coaxial
5.d.12	//As required//	HDTV/Nurses Call Interface/ Control
5.d.13	//As required//	Auxiliary Mounting Interface
5.e	//As required//	Emergency Station(s)
5.e.1	//As required//	Equipment Back Box(s)
5.e.2	//As required//	Toilet Emergency Station (waterproof)
5.e.3	//As required//	Shower Emergency Station (waterproof)
5.e.4	//As required//	Lavatory Emergency Station (waterproof)
5.f.	//As required//	Room Dome Light
5.f.1	//As required//	Equipment Back Box(s)
5.g	//As required//	Other Dome Light(s)
5.g.1	//As required//	Equipment Back Box(s)
5.g.2	//As required//	Corridor Dome Light
5.g.3	//As required//	Intersectional Dome Light
5.h	//As required//	System Cable(s)
5.h.1	//As required//	Coaxial
5.h.2	//As required//	System Pin
5.h.3	//As required//	Audio
5.h.4	//As required//	Control
5.h.5	//As required//	Video
5.i	//As required//	System Connector(s)
5.i.1	//As required//	Coaxial

5.i.2	//As required//	System Pin
5.i.2	//As required//	Audio
5.i.3	//As required//	Control
5.i.4	//As required//	Video
5.j	//As required//	Wire Management Required as described herein
//6.	//As required//	Mental Health Unit
6.a	//As required//	Head End Function(s)
6.a.1	//As required//	H7 Interface
6.a.2	//As required//	Nurse Locator
6.a.3	//As required//	Staff Locator
6.b.	//As required//	Master Station(s)
6.b.1	//As required//	Nurse Locator
6.b.2	//As required//	Staff Locator
6.c	//As required//	Distribution System(s)
6.c.1	//As required//	Staff Station
6.c.1.a	//As required//	Equipment Back Box(s)
6.c.2	//As required//	Duty Station
6.c.2.a	//As required//	Equipment Back Box(s)
6.c.3	//As required//	Patient Station(s)
6.c.3.a	//As required//	Equipment Back Box(s)\
6.c.4	//As required//	Security Room(s)
6.c.4.a	//As required//	Security Station(s)
6.c.4.b	//As required//	Equipment Back Box(s)\
6.c.4.c	//As required//	Overhead Speaker/Microphone
6.c.4.d	//As required//	Equipment Back Box(s)\
6.c.4.e	//As required//	TV Surveillance System
6.c.4.f	//As required//	Equipment Back Box(s)\
6.c.4.g	//As required//	TV Interconnection Cables
6.c.4.h	//As required//	Audio Interconnection Cables
6.c.5	//As required//	Emergency Station(s)
6.c.5.a	//As required//	Equipment Back Box(s)
6.c.5.b	//As required//	Toilet Emergency Station (waterproof)
6.c.5.c	//As required//	Shower Emergency Station (waterproof)
6.c.5.d	//As required//	Lavatory Emergency Station (waterproof)
6.c.6	//As required//	Room Dome Light
6.c.7	//As required//	Other Dome Light(s)
6.c.7.a	//As required//	Equipment Back Box(s)
6.c.7.b	//As required//	Corridor Dome Light
6.c.7.c	//As required//	Intersectional Dome Light
6.c.8	//As required//	System Cable(s)
6.c.8.a	//As required//	Coaxial
6.c.8.b	//As required//	System Pin
6.c.8.c	//As required//	Audio
6.c.8.d	//As required//	Control
6.c.8.e	//As required//	Video
6.c.9	//As required//	System Connector(s)
6.c.9.a	//As required//	Coaxial
6.c.9.b	//As required//	System Pin
6.c.9.c	//As required//	Audio
6.c.9.d	//As required//	Control
6.c.9.e	//As required//	Video

6.c.9.f	//As required//	Wire Management Required as described herein//
//7	//As required//	Blind Rehabilitation Unit
7.a	//As required//	Head End Function(s)
7.a.1	//As required//	H7 Interface
7.a.2	//As required//	Nurse Locator
7.a.3	//As required//	Staff Locator
7.b.	//As required//	Master Station(s)
7.b.1	//As required//	Nurse Locator
7.b.2	//As required//	Staff Locator
7.c	//As required//	Distribution System(s)
7.c.1	//As required//	Staff Station
7.c.1.a	//As required//	Equipment Back Box(s)
7.c.2	//As required//	Duty Station
7.c.2.a	//As required//	Equipment Back Box(s)
7.c.3	//As required//	Patient Station(s)
7.c.3.a	//As required//	Equipment Back Box(s)\
7.c.4	//As required//	Emergency Station(s)
7.c.4.a	//As required//	Equipment Back Box(s)
7.c.4.b	//As required//	Toilet Emergency Station (waterproof)
7.c.4.c	//As required//	Shower Emergency Station (waterproof)
7.c.4.d	//As required//	Lavatory Emergency Station (waterproof)
7.c.5	//As required//	Room Dome Light
7.c.5.a	//As required//	Equipment Back Box(s)
7.c.6	//As required//	Other Dome Light(s)
7.c.6.a	//As required//	Equipment Back Box(s)
7.c.6.b	//As required//	Corridor Dome Light
7.c.6.c	//As required//	Intersectional Dome Light
7.c.7	//As required//	System Cable(s)
7.c.7.a	//As required//	Coaxial
7.c.6.b	//As required//	System Pin
7.c.7.c	//As required//	Audio
7.c.7.d	//As required//	Control
7.c.7.e	//As required//	Video
7.c.8	//As required//	System Connector(s)
7.c.8.a	//As required//	Coaxial
7.c.8.b	//As required//	System Pin
7.c.8.c	//As required//	Audio
7.c.8.d	//As required//	Control
7.c.8.e	//As required//	Video
7.c.9	//As required//	Wire Management Required as described herein//
//8.	//As required//	Center for the Aging (aka Nursing Home Care Unit)
8.a	//As required//	Head End Function(s)
8.a.1	//As required//	H7 Interface
8.a.2	//As required//	Nurse Locator
8.a.3	//As required//	Staff Locator
8.b.	//As required//	Master Station(s)
8.b.1	//As required//	Nurse Locator
8.b.2	//As required//	Staff Locator
8.c	//As required//	Distribution System(s)

8.c.1	//As required//	Staff Station
8.c.1.a	//As required//	Equipment Back Box(s)
8.c.2	//As required//	Duty Station
8.c.2.a	//As required//	Equipment Back Box(s)
8.c.3	//As required//	Patient Station(s)
8.c.3.a	//As required//	Equipment Back Box(s)\
8.c.4	//As required//	Security Room(s)
8.c.4.a	//As required//	Security Station(s)
8.c.4.b	//As required//	Equipment Back Box(s)\
8.c.4.c	//As required//	Overhead Speaker/Microphone
8.c.4.d	//As required//	Equipment Back Box(s)\
8.c.4.e	//As required//	TV Surveillance System
8.c.4.f	//As required//	Equipment Back Box(s)\
8.c.4.g	//As required//	TV Interconnection Cables
8.c.4.h	//As required//	Audio Interconnection Cables
8.c.5	//As required//	Emergency Station(s)
8.c.5.a	//As required//	Equipment Back Box(s)
8.c.5.b	//As required//	Toilet Emergency Station (waterproof)
8.c.5.c	//As required//	Shower Emergency Station (waterproof)
8.c.5.d	//As required//	Lavatory Emergency Station (waterproof)
8.c.6	//As required//	Room Dome Light
8.c.7	//As required//	Other Dome Light(s)
8.c.7.a	//As required//	Equipment Back Box(s)
8.c.7.b	//As required//	Corridor Dome Light
8.c.7.c	//As required//	Intersectional Dome Light
8.c.8	//As required//	System Cable(s)
8.c.8.a	//As required//	Coaxial
8.c.8.b	//As required//	System Pin
8.c.8.c	//As required//	Audio
8.c.8.d	//As required//	Control
8.c.8.e	//As required//	Video
8.c.9	//As required//	System Connector(s)
8.c.9.a	//As required//	Coaxial
8.c.9.b	//As required//	System Pin
8.c.9.c	//As required//	Audio
8.c.9.d	//As required//	Control
8.c.9.e	//As required//	Video
8.c.9.f	//As required//	Wire Management Required as described herein//
//9.	As required//	Oncology, Radiology, Dialysis, Units (These units are treated the same as Blind Rehabilitation Unit EXCEPT it does contains a CODE BLUE Function. If these units are provided as a part of the project, AT A MINIMUM - DUPLI-CATE THE BLINE REHABILITATION UNIT'S EQUIPMETN LISTE AND EDIT AND RENUMBER ACCORD-INGLY)//

10.

On Hand Spares Provide a separate system spares list as indicated in each equipment description.

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:

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.

D. 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-0050P3B) Certified meeting Life Safety Standards.
 - e. Provide one (1) spare HL Interface unit.

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:

9. TER

a. Paging adaptor (When connections are specifically approved by TVE 0050P3B):

- 1) The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility's telephone system with the Facility Telephone Contractor or local telephone company.
- 2) The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility's Telephone Contractor. The Paging Adapter shall:
 - a) Monitor each audio input and output on the unit.
 - b) Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.
 - c) Be provided as part of the headend equipment and shall be located in the Telephone Switch Room.
 - d) Be provide with Executive Paging Override of all routine paging calls in progress or being accessed to allow system "all call" (aka global) and radio paging calls designated as Code One Blue) functions.
 - e) Be capable of internal time out capability.
 - f) Function completely with the interface module.
 - g) Provide one spare adapter.
- 3) Time Out Device:

A time out device/capability shall be provided to prevent system "hang-up" due to an off-hook telephone. The device shall be able to be preset from 30 seconds to two (2) minutes. Its function shall not interfere with or override the required "all call" (aka global) operational capability.

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.
- c 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.

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 - 0050P3B 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 0050P2B 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.
- 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 0050P3B 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 0050P3B 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 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 - 0050P3B).

- 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 plenumrated.

- 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 0050P3B.
 - 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 (0050P3B).
 - 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. Where 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.
 - 15) Grounding Blocks.
3. Fiber optic Cable: The fiber optic cable kit shall include all fiber optic 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 (07A2) at 202-461-5301/5311 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

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 0050P3B.
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's 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 too:

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 $\frac{3}{4}$ " plywood or $\frac{1}{8}$ " 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 prevents 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 too:

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 - TESTING / TRAINING

4.0 SYSTEM LISTING

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 provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

4.1 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

1. After completion of 30 - 40% of the installation of a head end cabinet(s) and 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-0050P3B 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 0050P3B 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 0050P3B 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 0050P3B 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.

4.2 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 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. 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.

4.3 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.

5.0 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).		

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Contract #36C77622R0059
Carrollton GA 30117

Project #508-349

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b.

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS				1. REQUISITION NUMBER		PAGE 1 OF	
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30						7	
2. CONTRACT NO.		3. AWARD/EFFECTIVE DATE SEE BLOCK 31C		4. ORDER NUMBER		5. SOLICITATION NO.	
7. FOR SOLICITATION INFORMATION		a. NAME				b. TELEPHONE NUMBER (No collect calls)	
9. ISSUED BY:		CODE		10. THIS ACQUISITION IS ☐ UNRESTRICTED ☐ SETASIDE: 100 % FOR ☐ SMALL BUSINESS ☐ HUBZONE SMALL BUSINESS ☐ 8(A) NAICS: 541511 SIZE STANDARD:		11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED ☐ SEE SCHEDULE ☐ 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700) 13b. RATING 14. METHOD OF SOLICITATION ☒ RFQ ☐ IFB ☐ RFP	
15. DELIVER TO		CODE		16. ADMINISTERED BY		CODE	
				See #9 above			
17a. CONTRACTOR/ CODE		FACILITY CODE		18a. PAYMENT WILL BE MADE BY		CODE	
OFFEROR				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			

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19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTI TY	22. UNI T	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)	

☐ 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. ☐ ARE NOT
FAR 52.212-3 AND 52.212-5 ARE ATTACHED. ADDENDA ARE ATTACHED.
☒ 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4, ☒ ARE ☐ ARE NOT
52.227-14, 52.227-16, and 52.227-19. ADDENDA ATTACHED.

☒ 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.		☐ 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:	
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
PREVIOUS EDITION IS NOT
USABLE

COMPUTER-GENERATED

STANDARD FORM 1449
(REV. 4/2002)
Prescribed By GSA
- FAR (48CFR) 53.212

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTI TY	22. UNI T	23. UNIT PRICE	24. AMOUNT

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

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(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.

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.

12 months of Standard Microsoft Word Software Maintenance and Technical Support Services for the software being acquired under CLIN 1; Part No. 9891-7069.

Total

4

EA

\$10,000.00

\$40,000.00

4

EA

\$2,500.00

\$10,000.00

\$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
☐ COMPLETE ☐
PARTIAL ☐ FINAL

37. CHECK
NUMBER

☐ PARTIAL
☐ 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

41b. SIGNATURE AND TITLE OF
CERTIFYING OFFICER

41c. DATE

42a. RECEIVED BY (Print)

42b. RECEIVED AT (Location)

42c. DATE REC'D
(YY/MM/DD)

42d. TOTAL CONTAINERS

STANDARD FORM

1449 (REV. 4/2002) BACK

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/>.

- 1) FAR 52.212-4, Contract Terms and Conditions-Commercial Items (Oct 2003)
- 2) FAR 52.227-14, Rights in Data-General (Dec 2007), Alt III
- 3) FAR 52.227-16, Additional Data Requirements (Jun 1987)
- 4) 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.

- (a) Licensee. The term "licensee" shall mean the U.S. Department of Veterans Affairs ("VA") and is synonymous with "Government."
- (b) 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.
- (c) Software. The term "software" shall mean the licensed computer software product(s) cited in the Schedule of Supplies (Page 2).
- (d) 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.
- (e) 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.
- (f) 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.
- (g) 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.

- (a) See also Addendum B.

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- (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.
- (c) The license authorizes the Government to use the software in processing data for other federal agencies.
- (d) 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.
- (e) 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.
- (f) 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.
- (g) 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).
- (h) 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.
- (i) 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.
- (j) 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.
- (k) All limitations of software usage are expressly stated in the SF 1449 and Addendum A and Addendum B.

(3) Software Maintenance Subscription and Technical Support.

- (a) See also Addendum B.
- (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).
- (c) 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.

- (d) 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.
- (e) 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.
- (f) Any telephone support provided by Contractor shall be at no additional cost.
- (g) 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).
- (h) 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



Spct Mgt Part 15
MOU, 09-2020.doc

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3. Risk Assessment



Spct Mgt Risk
Assest, 07-2016.doc

- - - E N D - - -

**SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.
- B. Furnish and install fully functional electronic safety and security cabling system(s), equipment and approved accessories in accordance with the specification section(s), drawing(s), and referenced publications. Capacities and ratings of cable and other items and arrangements for the specified items are shown on each system's required Bill of Materials (BOM) and verified on the approved system drawing(s). If there is a conflict between contract's specification(s) and drawings(s), the contract's specification requirements shall prevail.
- C. The Contractor shall provide a fully functional and operating ESS, programmed, configured, documented, and tested as required herein and the respective Safety and Security System Specification(s). The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.
- D. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include but not limited to: physical access control, fire alarm interface, and uninterruptible power supplies (UPS) interface. Operator training shall not be required as part of the Security Contractors scope and shall be provided by the Owner. The Security Contractor shall still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the

procurement and installation of electrical wire and cables, the installation and testing of all system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and workmanship, shall be as specified herein. The Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits.

E. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under "Emergency Service". The Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. The Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall provide 24-hour telephone support for the software program at no additional charge to the owner. Software support shall include all software updates that occur during the warranty period.

F. Section Includes:

1. Description of Work for Electronic Security Systems,
2. Electronic security equipment coordination with relating Divisions,
3. Submittal Requirements for Electronic Security,
4. Miscellaneous Supporting equipment and materials for Electronic Security,
5. Electronic security installation requirements.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.
- D. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- . Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
- E. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- F. Section 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
- G. Section 26 05 41 - UNDERGROUND ELECTRICAL CONSTRUCTION. Requirements for underground installation of wiring.
- H. Section 26 56 00 - EXTERIOR LIGHTING. Requirements for perimeter lighting.
- I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- J. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- K. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- L. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

1.3 DEFINITIONS

- A. AGC: Automatic Gain Control.
- B. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- C. BICSI: Building Industry Consulting Service International.
- D. CCD: Charge-coupled device.
- E. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

- F. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
- G. CPU: Central processing unit.
- H. Credential: Data assigned to an entity and used to identify that entity.
- I. DGP: Data Gathering Panel - component of the Physical Access Control System capable to communicate, store and process information received from readers, reader modules, input modules, output modules, and Security Management System.
- J. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.
- K. EMI: Electromagnetic interference.
- L. EMT: Electric Metallic Tubing.
- M. ESS: Electronic Security System.
- N. GFI: Ground fault interrupter.
- O. IDC: Insulation displacement connector.
- P. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- Q. I/O: Input/Output.
- R. Intrusion Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.
- S. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- T. LAN: Local area network.
- U. LCD: Liquid-crystal display.
- V. LED: Light-emitting diode.
- W. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop.

Where this term is presented with an initial capital letter, this definition applies.

- X. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- Y. M-JPEG: Motion - Joint Photographic Experts Group.
- Z. MPEG: Moving picture experts group.
- AA. NEC: National Electric Code
- BB. NEMA: National Electrical Manufacturers Association
- CC. NFPA: National Fire Protection Association
- DD. NTSC: National Television System Committee.
- EE. NICET: National Institute for Certification in Engineering Technologies
- FF. NRTL: Nationally Recognized Testing Laboratory.
- GG. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- HH. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).
- II. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
- JJ. RCDD: Registered Communications Distribution Designer.
- KK. RFI: Radio-frequency interference.
- LL. RIGID: Rigid conduit is galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.
- MM. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
- OO. RS-485: An TIA/EIA standard for multipoint communications.
- PP. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- QQ. SMS: Security Management System - A SMS is software that incorporates multiple security subsystems (e.g., physical access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.

RR. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

SS. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

TT. UPS: Uninterruptible Power Supply

UU. UTP: Unshielded Twisted Pair

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies

of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The COR reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 GENERAL ARRANGEMENT OF CONTRACT DOCUMENTS

- A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper

installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner's representative for his or her comment and/or approval before initiating work.

- B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
1. Mark the submittals, "SUBMITTED UNDER SECTION _____".
 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 3. Submit each section separately.
- D. The submittals shall include the following:
1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
 2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior

- problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breadth or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:
1. The Contractor shall schedule submittals in order to maintain the project schedule.
 2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
 3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
 4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for COR and Contractor review stamps.
 5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards CAD Standard Application Guide, and VA BIM Guide. FREEHAND SKETCHES OR

COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED.

The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings.

If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the COR for approval before the initiation of work.

6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
 - a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
 - 1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
 - 2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
 - b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
 - c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
 - d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20-pound white bond paper.
 - e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.

- 1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
 - 2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.
 - 3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16" tall.
- f. Manual Content: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
- 1) Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test and furnish the remaining manuals prior to contract completion.
 - 2) Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
 - 3) The manuals shall include:
 - a) Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b) A control sequence describing start-up, operation, and shutdown.
 - c) Description of the function of each principal item of equipment.
 - d) Installation and maintenance instructions.
 - e) Safety precautions.
 - f) Diagrams and illustrations.

- g) Testing methods.
 - h) Performance data.
 - i) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
 - j) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.
- h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.
- i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols, and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
- j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.

- k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.
 - l. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.
 - m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.
 - n. Calculations: Provide a section for circuit and panel calculations.
 - o. Loading Sheets: Provide a section for DGP Loading Sheets.
 - p. Certifications: Provide section for Contractor's manufacturer certifications.
7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature

certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.

8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

F. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:

1. Section I - Drawings:

a. General - Drawings shall conform to VA CAD Standards Guide. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings.

b. Cover Sheet - Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.

c. General Information Sheets - General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.

d. Floor Plans - Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:

1) Security devices by symbol,

2) The associated device point number (derived from the loading sheets),

- 3) Wire & cable types and counts
- 4) Conduit sizing and routing
- 5) Conduit riser systems
- 6) Device and area detail call outs
- e. Architectural details - Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,
- f. Riser Diagrams - Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
- g. Block Diagrams - Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
- h. Interconnection Diagrams - Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.
- i. Security Details:
 - 1) Panel Assembly Detail - For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
 - 2) Panel Details - Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
 - 3) Device Mounting Details - Provide mounting detailed drawing for each security device (physical access control system for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.

- 4) Details of connections to power supplies and grounding
- 5) Details of surge protection device installation
- 6) Equipment Rack Detail - For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCII wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal ladder rack system.
- 7) Equipment Room - Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.
- j. Electrical Panel Schedule - Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.
- k. Door Schedule - A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
 - 1) Item Number
 - 2) Door Number (Derived from A/E Drawings)
 - 3) Floor Plan Sheet Number
 - 4) Standard Detail Number
 - 5) Door Description (Derived from Loading Sheets)
 - 6) Data Gathering Panel Input Number
 - 7) Door Position or Monitoring Device Type & Model Number
 - 8) Lock Type, Model Number & Power Input/Draw (standby/active)
 - 9) Card Reader Type & Model Number
 - 10) Shunting Device Type & Model Number
 - 11) Sounder Type & Model Number
 - 12) Manufacturer
 - 13) Misc. devices as required
 - a) Electric Transfer Hinge
 - b) Electric Pass-through device

- 14) Remarks column indicating special notes or door configurations
2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the COR to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
 - a. Item Number
 - b. Camera Number
 - c. Naming Conventions
 - d. Description of Camera Coverage
 - e. Camera Location
 - f. Floor Plan Sheet Number
 - g. Camera Type
 - h. Mounting Type
 - i. Standard Detail Reference
 - j. Power Input & Draw
 - k. Power Panel Location
 - l. Remarks Column for Camera
3. Section II - Data Gathering Panel Documentation Package
 - a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
 - b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by VA. A separate spreadsheet file shall be generated for each DGP and associated field panels.
 - c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file

name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.

- d. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
- e. The DGP spreadsheet shall include an entry section for the following information:
 - 1) DGP number
 - 2) First Reader Number
 - 3) First Monitor Point Number
 - 4) First Relay Number
 - 5) DGP, input or output Location
 - 6) DGP Chain Number
 - 7) DGP Cabinet Tamper Input Number
 - 8) DGP Power Fail Input Number
 - 9) Number of Monitor Points Reserved For Expansion Boards
 - 10) Number of Control Points (Relays) Reserved For Expansion Boards
- f. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
 - 1) System Numbers for Card Readers
 - 2) System Numbers for Monitor Point Inputs
 - 3) System Numbers for Control Points (Relays)
 - 4) Next DGP or input module First Monitor Point Number
 - 5) Next DGP or output module First Control Point Number
- g. The DGP spreadsheet shall provide the following information for each card reader:
 - 1) DGP Reader Number
 - 2) System Reader Number
 - 3) Cable ID Number
 - 4) Description Field (Room Number)

- 5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
 - 6) Description Field
 - 7) DGP Input Location
 - 8) Date Test
 - 9) Date Passed
 - 10) Cable Type
 - 11) Camera Numbers (of cameras viewing the reader location)
- h. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).
- 1) DGP Monitor Point Input Number
 - 2) System Monitor Point Number
 - 3) Cable ID Number
 - 4) Description Field (Room Number)
 - 5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
 - 7) DGP or input module Input Location
 - 8) Date Test
 - 9) Date Passed
 - 10) Cable Type
 - 11) Camera Numbers (of associated alarm event preset call-ups)
- i. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
- 1) DGP Control Point (Relay) Number
 - 2) System (Control Point) Number
 - 3) Cable ID Number
 - 4) Description Field (Room Number)
 - 5) Description Field (Device: Lock Control, Local Sounder, etc.)
 - 6) Description Field
 - 7) DGP or OUTPUT MODULE Output Location
 - 8) Date Test
 - 9) Date Passed Cable Type
 - 10) Camera Number (of associated alarm event preset call-ups)
- j. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
- 1) Header
 - a) DGP Input and Output Worksheet

- b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
 - 2) Footer
 - a) File Name
 - b) Date Printed
 - c) Page Number
- 3. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
- 5. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
 - a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
 - b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
 - c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
- 6. Section VI - Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".
- G. Group II Technical Data Package
 - 1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the COR documenting changes to the site,

- particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the COTR.
2. System Configuration and Functionality: The contractor shall provide the results of the meeting with VA to develop system requirements and functionality including but not limited to:
- a. Baseline configuration
 - b. Access levels
 - c. Schedules (intrusion detection, physical access control, holidays, etc.)
 - d. Badge database
 - e. System monitoring and reporting (unit level and central control)
 - f. Naming conventions and descriptors
- H. Group III Technical Data Package
1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and be customized to the contract requirements. The Contractor will deliver the test procedures to the COR for approval at least 60 calendar days prior to the requested test date.
- I. Group IV Technical Data Package
1. Performance Verification Test
- a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the COR for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.

2. Training Documentation

- a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for VA technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.

3. System Configuration and Data Entry:

- a. The Contractor is responsible for compiling the card access database for the VA employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.
- b. Refer to Part 3 for system programming requirements and planning guidelines.

4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and request from the COTR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the COR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

- J. Group V Technical Data Package: Final copies of the manuals shall be delivered to the COR as part of the acceptance test. The draft copy

used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
 - a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data

formats, command characters, and a sample of each type of data transfer.

4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:
 - a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.
5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the COR a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
 - a. Equipment and/or system function.
 - b. Operating characteristics.
 - c. Limiting conditions.
 - d. Performance curves.
 - e. Engineering data and test.
 - f. Complete nomenclature and number of replacement parts.

- g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
 - h. Provide information detailing essential maintenance procedures including the following: routine operations, troubleshooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
 - i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
 - j. Manufacturer equipment and systems maintenance manuals are permissible.
9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the COR or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the COR for review and approval of all changes or modifications to the documents. Each sheet shall have COR initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".
10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications

issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the COTR. As with master relines, Contractor shall maintain record specifications for COR review and inspection at any time.

11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the COTR.
12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include a minimum of the following:
 - a. Certificates received instead of labels on bulk products.
 - b. Testing and qualification of tradesmen. ("Contractor's Qualifications")
 - c. Documented qualification of installation firms.

- d. Load and performance testing.
 - e. Inspections and certifications.
 - f. Final inspection and correction procedures.
 - g. Project schedule
13. Record Construction Documents (Record As-Built)
- a. Upon project completion, the contractor shall submit the project master redlines to the COR prior to development of Record construction documents. The COR shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the COR, the COR will initial and date each sheet and turn redlines over to the contractor for as built development.
 - b. The Contractor shall provide the COR a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the COTR. If, in the opinion of the COTR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the Owner. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the owner.
 - c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the COTR. The Contractor shall organize into bound and labeled sets for the COTR's continued usage. Provide device,

conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

K. FIPS 201 Compliance Certificates

1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:
 - a. Card Readers
 - b. Facial Image Capturing Camera
 - c. Template Matcher
 - d. Electromagnetically Opaque Sleeve
 - e. Certificate Management
 - 1) CAK Authentication System
 - 2) PIV Authentication System

L. Approvals will be based on complete submission of manuals together with shop drawings.

M. After approval and prior to installation, furnish the COR with one sample of each of the following:

1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
2. Each type of conduit and pathway coupling, bushing and termination fitting.
3. Conduit hangers, clamps and supports.
4. Duct sealing compound.

N. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

N. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see typical active systems in operation, when there has been no prior

experience with the manufacturer or the type of equipment being submitted.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/ International Code Council (ICC):
- A117.1.....Standard on Accessible and Usable Buildings and Facilities
- C. American National Standards Institute (ANSI)/ Security Industry Association (SIA):
- AC-03.....Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards
- CP-01-00.....Control Panel Standard-Features for False Alarm Reduction
- PIR-01-00.....Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity
- TVAC-01.....CCTV to Access Control Standard - Message Set for System Integration
- D. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
- 330-09.....Electrical Performance Standards for CCTV Cameras
- 375A-76.....Electrical Performance Standards for CCTV Monitors
- E. American National Standards Institute (ANSI):
- ANSI S3.2-99.....Method for measuring the Intelligibility of Speech over Communications Systems
- F. American Society for Testing and Materials (ASTM)
- B1-07.....Standard Specification for Hard-Drawn Copper Wire
- B3-07.....Standard Specification for Soft or Annealed Copper Wire

- B8-04.....Standard Specification for Concentric-Lay-
Stranded Copper Conductors, Hard, Medium-Hard,
or Soft
- C1238-97 (R03).....Standard Guide for Installation of Walk-Through
Metal Detectors
- D2301-04.....Standard Specification for Vinyl Chloride
Plastic Pressure Sensitive Electrical
Insulating Tape
- G. Architectural Barriers Act (ABA), 1968
- H. Department of Justice: American Disability Act (ADA)
28 CFR Part 36-2010 ADA Standards for Accessible Design
- I. Department of Veterans Affairs:
VHA National CAD Standard Application Guide, 2006
VA BIM Guide, V1.0 10
- J. Federal Communications Commission (FCC):
(47 CFR 15) Part 15 Limitations on the Use of Wireless
Equipment/Systems
- K. Federal Information Processing Standards (FIPS):
FIPS-201-1.....Personal Identity Verification (PIV) of Federal
Employees and Contractors
- L. Federal Specifications (Fed. Spec.):
A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed
Installation)
- M. Government Accountability Office (GAO):
GAO-03-8-02.....Security Responsibilities for Federally Owned
and Leased Facilities
- N. Homeland Security Presidential Directive (HSPD):
HSPD-12.....Policy for a Common Identification Standard for
Federal Employees and Contractors
- O. Institute of Electrical and Electronics Engineers (IEEE):
81-1983.....IEEE Guide for Measuring Earth Resistivity,
Ground Impedance, and Earth Surface Potentials
of a Ground System
- 802.3af-08.....Power over Ethernet Standard
- 802.3at-09 Power over Ethernet (PoE) Plus Standard
- C2-07.....National Electrical Safety Code

C62.41-02.....IEEE Recommended Practice on Surge Voltages in
Low-Voltage AC Power Circuits

C95.1-05.....Standards for Safety Levels with Respect to
Human Exposure in Radio Frequency
Electromagnetic Fields

P. International Organization for Standardization (ISO):

7810.....Identification cards - Physical characteristics

7811.....Physical Characteristics for Magnetic Stripe
Cards

7816-1.....Identification cards - Integrated circuit(s)
cards with contacts - Part 1: Physical
characteristics

7816-2.....Identification cards - Integrated circuit cards
- Part 2: Cards with contacts -Dimensions and
location of the contacts

7816-3.....Identification cards - Integrated circuit cards
- Part 3: Cards with contacts - Electrical
interface and transmission protocols

7816-4.....Identification cards - Integrated circuit cards
- Part 11: Personal verification through
biometric methods

7816-10.....Identification cards - Integrated circuit cards
- Part 4: Organization, security and commands
for interchange

14443.....Identification cards - Contactless integrated
circuit cards; Contactless Proximity Cards
Operating at 13.56 MHz in up to 5 inches
distance

15693.....Identification cards -- Contactless integrated
circuit cards - Vicinity cards; Contactless
Vicinity Cards Operating at 13.56 MHz in up to
50 inches distance

19794.....Information technology - Biometric data
interchange formats

Q. National Electrical Contractors Association

303-2005.....Installing Closed Circuit Television (CCTV)
Systems

R. National Electrical Manufacturers Association (NEMA):

250-08.....Enclosures for Electrical Equipment (1000 Volts
Maximum)

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and
Tubing

FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

S. National Fire Protection Association (NFPA):

70-23..... National Electrical Code (NEC)

731-23.....Standards for the Installation of Electric
Premises Security Systems

99-24.....Health Care Facilities

T. National Institute of Justice (NIJ)

0601.02-03.....Standards for Walk-Through Metal Detectors for
use in Weapons Detection

0602.02-03.....Hand-Held Metal Detectors for Use in Concealed
Weapon and Contraband Detection

U. National Institute of Standards and Technology (NIST):

IR 6887 V2.1.....Government Smart Card Interoperability
Specification (GSC-IS)

Special Pub 800-37.....Guide for Applying the Risk Management
Framework to Federal Information Systems

Special Pub 800-63.....Electronic Authentication Guideline

Special Pub 800-73-3....Interfaces for Personal Identity Verification
(4 Parts)

.....Pt. 1- End Point PIV Card Application
Namespace, Data Model & Representation

.....Pt. 2- PIV Card Application Card Command
Interface

.....Pt. 3- PIV Client Application Programming
Interface

.....Pt. 4- The PIV Transitional Interfaces & Data
Model Specification

Special Pub 800-76-1....Biometric Data Specification for Personal
Identity Verification

- Special Pub 800-78-2....Cryptographic Algorithms and Key Sizes for
Personal Identity Verification
- Special Pub 800-79-1....Guidelines for the Accreditation of Personal
Identity Verification Card Issuers
- Special Pub 800-85B-1...DRAFTPIV Data Model Test Guidelines
- Special Pub 800-85A-2...PIV Card Application and Middleware Interface
Test Guidelines (SP 800-73-3 compliance)
- Special Pub 800-96.....PIV Card Reader Interoperability Guidelines
- Special Pub 800-104A....Scheme for PIV Visual Card Topography
- V. Occupational and Safety Health Administration (OSHA):
 - 29 CFR 1910.97.....Nonionizing radiation
- W. Section 508 of the Rehabilitation Act of 1973
- X. Security Industry Association (SIA):
 - AG-01 Security CAD Symbols Standards
- Y. Underwriters Laboratories, Inc. (UL):
 - 1-05.....Flexible Metal Conduit
 - 5-04.....Surface Metal Raceway and Fittings
 - 6-07.....Rigid Metal Conduit
 - 44-05.....Thermoset-Insulated Wires and Cables
 - 50-07.....Enclosures for Electrical Equipment
 - 83-08.....Thermoplastic-Insulated Wires and Cables
 - 294-99.....The Standard of Safety for Access Control
System Units
 - 305-08.....Standard for Panic Hardware
 - 360-09.....Liquid-Tight Flexible Steel Conduit
 - 444-08.....Safety Communications Cables
 - 464-09.....Audible Signal Appliances
 - 467-07.....Electrical Grounding and Bonding Equipment
 - 486A-03.....Wire Connectors and Soldering Lugs for Use with
Copper Conductors
 - 486C-04.....Splicing Wire Connectors
 - 486D-05.....Insulated Wire Connector Systems for
Underground Use or in Damp or Wet Locations
 - 486E-00.....Equipment Wiring Terminals for Use with
Aluminum and/or Copper Conductors
 - 493-07.....Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable

514A-04.....	Metallic Outlet Boxes
514B-04.....	Fittings for Cable and Conduit
51-05.....	Schedule 40 and 80 Rigid PVC Conduit
609-96.....	Local Burglar Alarm Units and Systems
634-07.....	Standards for Connectors with Burglar-Alarm Systems
636-01.....	Standard for Holdup Alarm Units and Systems
639-97.....	Standard for Intrusion-Detection Units
651-05.....	Schedule 40 and 80 Rigid PVC Conduit
651A-07.....	Type EB and A Rigid PVC Conduit and HDPE Conduit
752-05.....	Standard for Bullet-Resisting Equipment
797-07.....	Electrical Metallic Tubing
827-08.....	Central Station Alarm Services
1037-09.....	Standard for Anti-theft Alarms and Devices
1635-10.....	Digital Alarm Communicator System Units
1076-95.....	Standards for Proprietary Burglar Alarm Units and Systems
1242-06.....	Intermediate Metal Conduit
1479-03.....	Fire Tests of Through-Penetration Fire Stops
1981-03.....	Central Station Automation System
2058-05.....	High Security Electronic Locks
60950.....	Safety of Information Technology Equipment
60950-1.....	Information Technology Equipment - Safety - Part 1: General Requirements

Z. Uniform Federal Accessibility Standards (UFAS) 1984

AA. United States Department of Commerce:

Special Pub 500-101 Care and Handling of Computer Magnetic Storage
Media

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.9 MAINTENANCE & SERVICE

A. General Requirements

1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work

1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The COR shall be advised in writing of the name of the designated service representative, and of any change in personnel. The COR shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work

1. The work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

E. System Inspections

1. These inspections shall include:
 - a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
 - 1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
 - 2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

F. Emergency Service

1. The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Owner with an emergency servicecenter telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
 - a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from notification.
Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.

- b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

G. Operation

- 1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

H. Records & Logs

- 1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

I. Work Request

- 1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date, and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

J. System Modifications

- 1. The Contractor shall make any recommendations for system modification in writing to the COR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COR. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

K. Software

- 1. The Contractor shall provide all software updates when approved by the Owner from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates

shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

1.10 MINIMUM REQUIREMENTS

- A. References to industry and trade association standards and codes are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.11 DELIVERY, STORAGE, & HANDLING

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
 - 1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
 - 2. Damaged equipment shall be, as determined by the COR, placed in first class operating condition, or be returned to the source of supply for repair or replacement.
 - 3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
 - 4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.12 PROJECT CONDITIONS

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4X enclosures.
 2. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 610 mm (24 in) thick. NEMA 250, Type 4X enclosures.
- B. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.
- C. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent.

1.13 EQUIPMENT AND MATERIALS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
1. Components of an assembled unit need not be products of the same manufacturer.
 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
 1. The Government shall have the option of witnessing factory tests.
The contractor shall notify the VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
 2. Four copies of certified test reports containing all test data shall be furnished to the COR prior to final inspection and not more than 90 days after completion of the tests.
 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.14 ELECTRICAL POWER

- A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the PACS and the Uninterruptible Power Supply (UPS) system so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.
- B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for 8 hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.
 1. Emergency Generator
 - a. Security Device Power Supplies (DGP, VASS, Card Access, Lock Power, etc.) powered from the security closets or remotely:
various locations

1.15 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION, & GROUNDING

- A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.
1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
 2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
 3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
 4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity.
- B. Grounding and Surge Suppression
1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
 2. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
 3. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
 4. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.

5. Locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with the best practices of the trade and manufactures installation instructions.
8. Protection should be provided at both ends of cabling.

1.16 COMPONENT ENCLOSURES

A. Construction of Enclosures

1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.
2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open but shall be in accessible when the door is closed.
5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections.

These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Tamper Provisions and Tamper Switches:

1. Enclosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches.
2. Tamper switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sight to any internal component before the switch activates.
3. Tamper switches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4 "tolerance. The tamper device or its components shall not be visible or accessible with common tools to bypass when the enclosure is in the secured mode.
4. The single gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 305 square mm shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance

- adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.
 8. All security screws shall be Torx-Post Security Screws.
 9. The contractor shall provide the owner with two (2) torx-post screwdrivers.

1.17 ELECTRONIC COMPONENTS

- A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

1.18 SUBSTITUTE MATERIALS & EQUIPMENT

- A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
- B. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. The COR shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the COR stating same. In the preparation of a list of substitutions, the following information shall be included, as a minimum:
 1. Identity of the material or devices specified for which there is a proposed substitution.
 2. Description of the segment of the specification where the material or devices are referenced.
 3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer's product name.
 4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-

feature, between specification requirements and the material or devices called for in the specification; and Price differential.

- C. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the COTR, some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications, but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the COR shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The COR shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.
- D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate "COMPLY" opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate "DOES NOT COMPLY" opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate "COMPARABLE". The offers shall include a statement fully describing the "comparable" method of satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

1.19 LIKE ITEMS

- A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.20 WARRANTY

- A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the COTR certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contractor received written notification of final acceptance from the COTR. Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the COTR's satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the COTR on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of it's failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.21 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. All equipment associated within the Security Control Room, Security Console and Security Equipment Room shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.
- B. All equipment shall operate on 120 or 240 volts alternating current (VAC); 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 8 hours of run time in the event of a loss of primary power to the facility.
- C. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.
- D. All equipment and materials for the system will be compatible to ensure correct operation.

2.2 EQUIPMENT ITEMS

- A. The Security Management System shall provide full interface with all components of the security subsystem as follows:
 - 1. Shall allow for communication between the Physical Access Control System and Database Management and all subordinate work and monitoring stations, enrollment centers for badging and biometric devices as part of the PACS, local annunciation centers, the electronic Security Management System (SMS), and all other VA redundant or backup command center or other workstations locations.
 - 2. Shall provide automatic continuous communication with all systems that are monitored by the SMS, and shall automatically annunciate any communication failures or system alarms to the SMS operator

- providing identification of the system, nature of the alarm, and location of the alarm.
3. Controlling devices shall be utilized to interface the SMS with all field devices.
- B. Security Console Bays - shall be EIA 310D compliant and:
1. Utilize stand-up, sit-down, and vertical equipment racks in any combination to monitor and control the security subsystems.
 2. Shall be wide enough for equipment that requires a minimum 19 inch (47.5 cm) mounting area.
 3. Shall be made of metal, furnished with wire ways, a power strip, a thermostatic controlled bottom or top mounted fan units, a hinge mounted rear door, a hinge mounted front door made of Plexiglas, and a louvered top. When possible, pre-fabricated (standard off-the-shelf) security console equipment shall be used in place of customized designed consoles.
 4. A wire management system shall be designed and installed so that all cables are mounted in a manner that they do not interfere with day-to-day operations, are labeled for quick identification, and so that high voltage power cables do not cause signal interference with low voltage and data carrying cables.
 5. Shall be mounted on lockable casters.
 6. Shall be ergonomically designed so that all devices requiring repetitive interaction with by the operator can be easily accessed, observed, and accomplished.
 7. Controls and displays shall be located so that they are not obscured during normal operation. Control and display units installed with a work bench shall be a minimum of 3 in. (7.5 cm) from all edges of the work bench area.
 8. All security subsystem controls shall be installed within the same operating console bay of their associated equipment.
 9. At least one workbench for every three (3) console bays shall be provided free of control equipment to allow for appropriate operator workspace.
 10. All console devices shall be labeled and marked with a minimum of quarter inch bold print.

11. All non-security related equipment that is required to be monitored shall be installed in a console bay separate from the security subsystem equipment and clearing be identified as such.
12. Console bays and related equipment shall be arranged in priority order and sequenced based upon their pre-defined security subsystem operations criticality established by the Contracting Officer.

C. Security Console Configuration:

1. The size shall be defined by the number of console bays required to house and operate the security subsystems, as well as any other factors that may influence the overall design of the space. A small Access Control System and Database Management shall contain no more than four (4) security console bays. A large Access Control System and Database Management shall contain no less than five (5) and no more than eight (8) security console bays.
2. Shall meet the following minimum spacing requirements to ensure that an Access Control System and Database Management is provided to house existing and future security subsystems and other equipment listed in paragraph 2.3.C:
 - a. 500 square feet for a large Access Control System and Database Management.
 - b. 300 square feet for a small Access Control System and Database Management.
 - c. If office, training room and conference space, is a processing area as well as holding cell space is to be located adjacent to the Access Control System and Database Management, these space requirements also need to be considered.
3. Shall be located in an area within, at a minimum, the first level/line of security defense defined by the VA. If the Access Control System and Database Management is to be located outside the first level of security, then the area shall be constructed or retrofit to meet or exceed those requirements outlined in associated VA Master Specifications.
4. Shall not be located within or near an area with little to no blast mitigation standoff space protection, adjacent to an outside wall exposed to vehicle parking and traffic, within a basement or potential flood zone area, in close approximately to major utility areas, or near an exposed air intake(s).

5. Access shall meet UFAS and ADA accessibility requirements.
6. Construction shall be slab to slab and free of windows, with the exception of a service window. All penetrations into the room shall be sealed with fire stopping materials. This material shall apply in accordance with Section 07 84 00, FIRESTOPPING.
7. A service window shall be installed in the wall next to the main entrance of the Access Control System and Database Management or where it best can be monitored and accessed by the security console operator. The window shall meet all requirements set forth in UL 752, to include at a minimum, Class III ballistic level protection. The windows shall be set in a minimum of four (4) inches (100 mm) solid concrete units to ceiling height with either masonry or gypsum wall board to the underside of the slab above. It shall also contain a service tray constructed in a manner that only objects no larger than 3 inches (7.5 cm) in width may pass through it.
8. The walls making up or surrounding the Access Control System and Database Management shall be made of materials that at a minimum offer Class III ballistic level protection for the security console operator(s).
9. There will be a main power cut-off button/switch located inside the Access Control System and Database Management in the event of an electrical fire or related event occurs.
10. Shall have a fire alarm detection unit that is tied into the main building fire alarm system and have at least two fire extinguishers located within it.
11. Shall utilize a fire suppression system similar to that used by the VA's computer and telecommunications room operating areas.
12. The floor shall be raised a minimum of 4 inches (10 cm) from the concrete floor base. Wire ways shall be utilized under the raised floor for separation of signal and power wires and cables.
13. Access shall be monitored and controlled by the PACS via card reader and fixed camera that utilizes a wide-angle lens. A 1 in. (2.5 cm) deadbolt shall be utilized as a mechanical override for the door in the event of electrical failure of the PACS, card reader, or locking mechanism.
14. There shall only be one point of ingress and egress to and from the Security Control Room. The door shall be made of solid core wood or

- better. If a window is required for the door, then the window shall be ballistic resistant with a Millar covering.
15. A two-way intercom shall be placed at the point of entry into the Security Control Room for access-communication control purposes.
 16. A remote push-button door unlocking device shall not be installed for the electronic PACS locking mechanism providing access control into the Security Control Room.
 17. All controlling equipment and power supplies that must be wall mounted shall be mounted in a manner that maximizes usability of the Security Control Room wall space. All equipment shall be mounted to three quarter inch fire retardant plywood. The plywood shall be fastened to the wall from slab to slab and fixed to the existing walls supports.

D. Wires and Cables:

1. Shall meet or exceed the manufactures recommendation for power and signals.
2. Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
4. All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.
5. Conduit fills shall not exceed 50 percent unless otherwise documented.
6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage

for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.

9. For all equipment that is carrying digital data between the Security Control Room, Security Equipment Room, Security Console, or at a remote monitoring station, it shall not be less than 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

2.3 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES (TVSS) AND SURGE SUPPRESSION

A. Transient Voltage Surge Suppression

1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:
 - a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
 - b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
 - c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
 - d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

B. Physical Access Control Systems

1. Suppressors shall be installed on AC power at the point of service and shall meet the following criteria:
 - a. UL1449 2nd Edition, 2007, listed
 - b. UL1449 S.V.R. of 400 Volts or lower
 - c. Status Indicator Light(s)
 - d. Minimum Surge Current Capacity: 40,000 Amps (8 x 20 μ sec)
 - e. Maximum Continuous Current: 15 Amps
 - f. MCOV: 125 VAC
 - g. Service Voltage: 110-120 VAC
2. Suppressors shall be installed on the Low Voltage circuit at both the point of entrance and exit of the building. Suppressors shall meet the following criteria:
 - a. UL 497B
 - b. Minimum Surge Current Capacity: 2,000 Amps per pair
 - c. Maximum Continuous Current: 5 Amps
 - d. MCOV: 33 Volts
 - e. Service Voltage: 24Volts
3. Suppressors shall be installed on the communication circuit between the access controller and card reader at both the entrance and exit of the building. Suppressors shall meet the following criteria:
 - a. Conforms with UL497B standards (where applicable)
 - b. Clamp level for 12 and 24V power: 18VDC / 38VDC
 - c. Clamp level for Data/LED: 6.8VDC
 - d. Service Voltage for Power: 12VDC/24VDC
 - e. Service Voltage for Data/LED: <5VDC
 - f. Clamp level - PoE Access Power: 72V
 - g. Clamp level - PoE Access Data: 7.9V
 - h. Service Voltage - PoE Access: 48VAC - 54VAC
 - i. Service Voltage - PoE Data: <5VDC

C. Grounding and Surge Suppression

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.

2. The Contractor shall engineer, provide, and install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.
3. Principal grounding components and features shall include: main grounding buses, grounding, and bonding connections to service equipment.
4. The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
5. The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufacturers' installation instructions.

D. 120 VAC Surge Suppression

1. Continuous Current: Unlimited (parallel connection)
2. Max Surge Current: 13,500 Amps
3. Protection Modes: L - N, L - G, N - G
4. Warranty: Ten Year Limited Warranty
5. Dimension: 73.7 x 41.1 x 52.1 mm (2.90 x 1.62 x 2.05 in)
6. Weight: 2.88 g (0.18 lbs)
7. Housing: ABS

2.5 INSTALLATION KIT

A. General:

1. 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. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:
2. System Grounding:
 - a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
 - b. This includes, but is not limited to:
 - 1) Coaxial Cable Shields
 - 2) Control Cable Shields
 - 3) Data Cable Shields
 - 4) Equipment Racks
 - 5) Equipment Cabinets
 - 6) Conduits
 - 7) Cable Duct blocks
 - 8) Cable Trays
 - 9) Power Panels
 - 10) Grounding
 - 11) Connector Panels
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. 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.
5. 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.
 6. 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.
 7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.
 8. 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 provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. Equipment location shall be as close as practical to locations shown on the drawings.

G. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.2 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 07 84 00 "Firestopping."

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 DEMONSTRATION AND TRAINING

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the COR at least 30 days prior to the planned training.
- D. Provide services of manufacturer's technical representative for 8 hours to instruct VA personnel in operation and maintenance of units.
- E. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

3.5 WORK PERFORMANCE

- A. Job site safety and worker safety is the responsibility of the contractor.
- B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

3.6 SYSTEM PROGRAMMING

- A. General Programming Requirements
 - 1. This following section shall be used by the contractor to identify the anticipated level of effort (LOE) required setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and programming to include data entry for the Security Management System (SMS) and subsystems (e.g., video matrix switch, intercoms, digital video recorders, intrusion devices, including integration of subsystems to the SMS (e.g., camera call up, time synchronization, intercoms). System programming for existing or new SMS servers shall not be conducted at the project site.
- B. Level of Effort for Programming
 - 1. The Contractor shall perform and complete system programming (including all data entry) at an offsite location using the Contractor's own copy of the SMS software. The Contractor's copy of the SMS software shall be of the Owners current version. Once system programming has been completed, the Contractor shall deliver the data to the COR on data entry forms and an approved electronic medium, utilizing data from the contract documents. The completed forms shall be delivered to the COR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires it. The Contractor shall not upload system programming until the COR has provided written approval. The Contractor is responsible

for backing up the system prior to uploading new programming data. Additional programming requirements are provided as follows:

- a. Programming for New SMS Server: The contractor shall provide all other system related programming. The contractor will be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, personnel photos, access schedules, personnel groupings) along with coordinating with COR for device configurations, standards, and groupings. VA shall provide database to support Contractor's data entry tasks. The contractor shall anticipate a weekly coordination meeting and working with COR to ensure data uploading is performed without incident of loss of function or data loss.
 - b. Programming for Existing SMS Servers: The contractor shall perform all related system programming except for personnel data as noted. The contractor will not be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, access schedules, personnel groupings). The contractor shall anticipate a weekly coordination meeting and working alongside of COR to ensure data uploading is performed without incident of loss of function or data loss. System programming for SMS servers shall be performed by using the Contractor's own server and software. These servers shall not be connected to existing devices or systems at any time.
2. The Contractor shall identify and request from the COR, any additional data needed to provide a complete and operational system as described in the contract documents.
 3. Contractor and COR coordination on programming requires a high level of coordination to ensure programming is performed in accordance with VA requirements and programming uploads do not disrupt existing systems functionality. The contractor shall anticipate a minimum a weekly coordination meeting. Contractor shall ensure data uploading is performed without incident of loss of function or data loss. The following Level of Effort Chart is provided to communicate the expected level of effort required by contractors on VA ESS projects. Calculations to determine actual levels of effort shall be confirmed by the contractor before project award.

Description of Systems	Description of Tasks						
	Develop System Loading Sheets	Coordination	Initial Set-up Configuration	Graphic Maps	System Programming	Final Checks	Level of Effort (Typical Tasks)
SMS Setup & Configuration	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., retrieve IP addresses, naming conventions, standard event descriptions, programming templates, coordinate special system needs	e.g., Load system Operating System and Application software, general system configurations	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., check all system diagnostics (e.g., clients, panels)	Load and set-up 4-6 CDs and configure servers (to configure Loading and Configuring software Administrative account, audit log, Keystrokes, mouse clicks, multi-screen configuration

Electronic Entry Control Systems	e.g., setup of device, door groups & schedules, REX, Locks, link graphics	e.g., confirming device configurations, naming conventions, event description and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., , setup of device, door groups & schedules, REX, Locks, link graphics	e.g., performing entry testing to confirm correct setup and configuration	e.g., creating a door, door configuration, adding request to exit, door monitors and relays, door timers, door related events (e.g., access, access denied, forced open, held open), linkages, controlled areas, advanced door monitoring, time zones, sequence of operations

CCTV Systems	e.g., programming call-ups recording	e.g., confirming device configurations, naming conventions	e.g., enter data from loading sheets; camera naming convention, sequence s, configure components)		e.g., programming call-ups recording	e.g., confirm area of coverage, call-up per event generated and recording rates	e.g., setting up cameras points, recording ratios (e.g., normal, alarm event) timed recording, linkages, maps placements, call-ups
Note: Programming tasks are supported through the contractor's development of the Technical Data Package Submittals.							

Table 1 Contractor Level of Effort

3.6 TESTING AND ACCEPTANCE

A. Performance Requirements

1. General:

- a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the COR at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.
- b. The COTR shall witness all testing and system adjustments during testing. Written permission shall be obtained from the COR before proceeding with the next phase of testing. Original copies of all data produced during performance verification and

endurance testing shall be turned over to the COR at the conclusion of each phase of testing and prior to COR approval of the test.

2. Test Procedures and Reports: The test procedures, compliant w/ VA standard test procedures, shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. The test reports shall be used to document results of the tests. The reports shall be delivered to the COR within seven (7) calendar days after completion of each test.

B. Pre-Delivery Testing

1. The purpose of the pre-delivery test is to establish that a system is suitable for installation. As such, pre-delivery test shall be a mock-up of the system as planned in the contract documents. The Contractor shall assemble the Security Test System at the Contractors local project within 50-miles of the project site, and perform tests to demonstrate the performance of the system complies with the contract requirements in accordance with the approved pre-delivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during pre-delivery testing, including results of each test procedure, shall be documented and delivered to the COR at the conclusion of pre-delivery testing and prior to COR's approval of the test. The test report shall be arranged so all commands, stimuli, and responses are correlated to allow logical interpretation. For Existing System modifications, the contractor shall provide their own server with loaded applicable software to support PDT.
2. Test Setup: The pre-delivery test setup shall include the following:
 - a. All console equipment.
 - 1) At least one of each type of data transmission media (DTM) and associated equipment to provide a fully integrated PACS.
 - 2) The number of local processors shall equal the amount required by the site design.

- 3) Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually or software generated.
 - 4) Contractor to prove to owner all systems are appropriately sized and configured as sized.
 - 5) Integration of VASS, intercom systems, other subsystems.
3. During the bidding process the contractor shall submit a request for information to the Owner to determine if a pre-delivery test will be required. If a pre-delivery test is not required, the contractor shall provide a written notification that the Pre-delivery Test is not required in their shop drawings submission.

C. Intermediate Testing

1. After completion of 30-50 percent of the installation of ESS cabinet(s) and equipment, one local and remote control stations and prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate FCC listing & UL certification labels are affixed, NFPA, Emergency, Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.

- D. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by a designated Government Representative and maintained on file by the COR, until completion of the entire project. The results will be compared to the Acceptance Test results.

E. Contractor's Field Testing (CFT)

1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD 142. The Contractor shall test all security systems and equipment, and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated

loading sheets documenting complete testing to COR approval. CFT test documentation package shall conform to submittal requirements outlined in this Section. The Contractor's field testing procedures shall be identical to the COR's acceptance testing procedures. The Contractor shall provide the COR with a written listing of all equipment and software indicating all equipment and components have been tested and passed. The Contractor shall deliver a written report to the COR stating the installed complete system has been calibrated, tested, and is ready to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written notice by contractor is received certifying that a contractors field test was successful.

F. Performance Verification Test (PVT)

1. Test team:

a. After the system has been pretested and the Contractor has submitted the pretest results and certification to the COR, then the Contractor shall schedule an acceptance test to date and give the COR written, notice as described herein, prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative, an OEM certified representative, representative of the Contractor and other approved by the COR. The system shall be tested utilizing the approved test equipment to certify proof of performance, FCC, UL and Emergency Service compliance. The test 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 Contractor shall demonstrate the completed Physical Access Control System PACS complies with the contract requirements. In addition, the Contractor shall provide written certification that the system is 100% operational prior to establishing a date for starting PVT. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT will be stopped and aborted as soon as 10 technical

deficiencies are found requiring correction. The Contractor shall be responsible for all travel and lodging expenses incurred for out-of-town personnel required to be present for resumption of the PVT. If the acceptance test is aborted, the re-test will commence from the beginning with a retest of components previously tested and accepted.

3. The PVT, as specified, shall not begin until receipt of written certification that the Contractors Field Testing was successful. This shall include certification of successful completion of testing as specified in paragraph "Contractor's Field Testing", and upon successful completion of testing at any time when the system fails to perform as specified. Upon termination of testing by the COR or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.
4. Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the COR prior to commencing the endurance test.
5. Additional Components of the PVT shall include:
 - a. System Inventory
 - 1) All Device equipment
 - 2) All Software
 - 3) All Logon and Passwords
 - 4) All Cabling System Matrices
 - 5) All Cable Testing Documents
 - 6) All System and Cabinet Keys
 - b. Inspection
 - 1) Contractor shall record an inspection punch list noting all system deficiencies. The contractor shall prepare an inspection punch list format for CORs approval.
 - 2) As a minimum the punch list shall include a listing of punch list items, punch list item location, description of item problem, date noted, date corrected, and details of how item was corrected.
6. Partial PVT - At the discretion of COR, the Performance Verification Test may be performed in part should a 100% compliant CFT be performed. In the event that a partial PVT will be performed instead of a complete PVT; the partial PVT shall be performed by

testing 10% of the system. The contractor shall perform a test of each procedure on select devices or equipment.

G. Endurance Test

1. The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified below. The endurance test shall not be started until the COR notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. VA shall operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing. VA will maintain a log of all system deficiencies. The COR may terminate testing at any time the system fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test, the Contractor shall verify the appropriate operation of the system. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the COR prior to acceptance of the system.
2. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COR. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the COR.
3. Phase II (Assessment):
 - a. After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COR. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
 - b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and

recommendations to the COR. The meeting shall not be scheduled earlier than five (5) business days after the COR receives the report. As part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the COR will provide a written determine of either the restart date or require Phase I be repeated.

4. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COTR.
5. Phase IV (Assessment):
 1. After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COTR. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
 2. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the COTR. The meeting shall not be scheduled earlier than five (5) business days after receipt of the report by the COTR. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions for the performance verification test. Based on the review meeting the test should not be scheduled earlier than five (5) business days after the COR receives the report. As a part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the COR will provide a written determine of either the restart date or require Phase III be repeated. After the conclusion of any re-testing which the COR may require, the Phase

IV assessment shall be repeated as if Phase III had just been completed.

H. Exclusions

1. The Contractor will not be held responsible for failures in system performance resulting from the following:
 - a. An outage of the main power in excess of the capability of any backup power source provided the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the PACS performed as specified.
 - b. Failure of an Owner furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.
 - c. Failure of existing Owner owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

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SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY. Requirements for infrastructure.
- F. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning.
- G. Section 31 20 00 - EARTH MOVING. For excavation and backfill for cables that are installed in conduit.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- F. NICET: National Institute for Certification in Engineering Technologies
- G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- H. RCDD: Registered Communications Distribution Designer.

- I. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- J. Surge Protection Devices (SPDs): A surge protective device (SPD) is a protective device for limiting transient voltages by diverting or limiting surge current and is capable of repeating these functions as specified.
- K. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- L. UTP: Unshielded twisted pair.

1.4 QUALITY ASSURANCE

- A. See section 28 05 00, Paragraph 1.4.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Manufacturer's Literature and Data: Showing each cable type and rating.
 - 2. Certificates: Two weeks prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and diagrams for cable management system.
 - 3. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
 - e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
 - 4. Wiring Diagrams. Show typical wiring schematics including the following:
 - a. Workstation outlets, jacks, and jack assemblies.

- b. Patch cords.
- c. Patch panels.
- 5. Cable Administration Drawings: As specified in Part 3
"Identification" Article.
- 6. Project planning documents as specified in Part 3.
- 7. Maintenance Data: For wire and cable to include in maintenance
manuals.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.
- B. American Society of Testing Material (ASTM):
 - D2301-17.....Standard Specification for Vinyl Chloride
Plastic Pressure Sensitive Electrical
Insulating Tape
- C. Federal Specifications (Fed. Spec.):
 - A-A-59544-13.....Cable and Wire, Electrical (Power, Fixed
Installation)
- D. National Fire Protection Association (NFPA):
 - 70-23.....National Electrical Code (NEC)
 - 262-23.....Standard Method of Test for Flame Travel and
Smoke of Wires and Cables for Use in Air-
Handling Spaces
- E. Underwriters Laboratories, Inc. (UL):
 - 44-18.....Thermoset-Insulated Wires and Cables
 - 83-17.....Thermoplastic-Insulated Wires and Cables
 - 467-13.....Electrical Grounding and Bonding Equipment
 - 486A-18.....Wire Connectors and Soldering Lugs for Use with
Copper Conductors
 - 486C-18.....Splicing Wire Connectors
 - 486D-15.....Insulated Wire Connector Systems for
Underground Use or in Damp or Wet Locations
 - 486E-15.....Equipment Wiring Terminals for Use with
Aluminum and/or Copper Conductors
 - 493-18.....Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable

514B-12.....	Fittings for Cable and Conduit
514B-2012.....	Fittings for Cable and Conduit
1283-2016.....	Standard for Control Units for Fire Protective Signaling Systems
1449-2021.....	Surge Protective Devices
1479-15.....	Fire Tests of Through-Penetration Fire Stops
1666-2015.....	Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

- A. Test cables upon receipt at Project site.
 1. Test each pair of UTP cable for open and short circuits.

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2.1 GENERAL

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2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 UTP CABLE

- A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
 - b. Communications, Plenum Rated: Type CMP; or MPP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
 - e. Multipurpose: Type MP or MPG; or MPP or MPR.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- B. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

- A. Description: Multimode, 62.5/125-micrometer, 24, nonconductive, tight buffer, optical fiber cable.
1. Comply with ICEA S-83-596 for mechanical properties.
 2. Comply with TIA/EIA-568-B.3 for performance specifications.

3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
 - e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, complying with UL 1666.
5. Conductive cable shall be aluminum armored type.
6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

B. Jacket:

1. Jacket Color: Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

- A. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
1. Quick-connect, simplex and duplex, Type SC, Type ST, Type LC, or Type MT-RJ connectors. Insertion loss shall be not more than 0.75 dB.
 2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM or CMG.
1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. PVC insulation.

3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.8 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Lock Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.

5. Flame Resistance: NFPA 262, Flame Test.

2.9 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in conduit, power-limited cable, concealed in building finishes, power-limited tray cable, in cable tray complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.10 FIRE ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG and
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.11 120V FIRE-ALARM CONTROL PANEL SURGE PROTECTIVE DEVICES (SPDS)

- A. Source Limitations: Obtain devices from single source from single manufacturer.
- B. Provide SPDs on nominal 120 V ac electrical circuits that supply power to main Fire-Alarm Control Panel (FACP).
 - 1. Provide units having series-wired design with replaceable surge-protection module.
- C. Alarms and Diagnostics:
 - 1. Provide units having audible alarm notification, LED diagnostic status indicator, and a Form C (SPDT) contact terminal block for remote notification of protection status.

D. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the following:
 - a. UL 1449, Type 1, or Type 2 SPD.
 - b. UL 1283 for EMI and RFI filtering.

F. Performance Criteria:

1. MCOV: 150 V.
2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase is 50 kA, minimum.
 - a. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
3. Maximum Operating Current: 20 A.
4. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits.
 - a. Line to Neutral: 700 V, maximum.
 - b. Line to Ground: 700 V, maximum.
 - c. Neutral to Ground: 1200 V, maximum.
 - d. Provide units that automatically self-restore without operator action.
5. SCCR: AIC rating of circuit-breaker feeding circuit, minimum.
6. Inominal Rating: 10 kA.

2.12 120 V FIRE-ALARM BOOSTER POWER SUPPLY CIRCUIT SURGE PROTECTIVE DEVICES

- A. Source Limitations: Obtain devices from single source from single manufacturer.
- B. Provide SPDs on nominal 120 V ac electrical circuits that supply booster power supply units.
- C. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1, or Type 2 SPD.

D. Performance Criteria:

1. MCOV: 150 V.
2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase is 50 kA, minimum.
 - a. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
3. Maximum Operating Current: 20 A.
4. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits.

- a. Line to Neutral: 700 V, maximum.
 - b. Line to Ground: 700 V, maximum.
 - c. Neutral to Ground: 1500 V, maximum.
 - d. Provide units that automatically self-restore without operator action.
5. SCCR: AIC rating of circuit-breaker feeding circuit, minimum.
 6. Inominal Rating: 10 kA.

2.13 FACP COMMUNICATION CIRCUIT SURGE PROTECTIVE DEVICES (SPDS)

- A. Source Limitations: Obtain devices from single source from single manufacturer.
- B. Provide SPDs on metal-conductor communication wiring and circuits extending outdoors, including telephone lines, Ethernet circuits, or wireless communication antenna cabling.
 1. Provide units having series-wired design.
- C. Standards:
 1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the following:
 - a. UL 497A, for telephone communication circuit SPD.
 - b. UL 497B, for Ethernet data and wireless communication SPD.
- E. Performance Criteria:
 1. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating is 10 kA, minimum.

2.14 FACP DATA AND SIGNALING CIRCUIT SURGE PROTECTIVE DEVICES (SPDS)

- A. Source Limitations: Obtain devices from single source from single manufacturer.
- B. Provide SPDs on metal-conductor data and signal wiring and circuits extending outdoors, including Signaling Line Circuit (SLC), Post Indicator Valve (PIV) supervision circuit, and Notification Appliance Circuit (NAC).
 1. Provide SPD having the following:
 - a. Series-wired design with replaceable surge-protection module.
 - b. Multistage, hybrid design that uses minimum two different types

C. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 497B, for data communications and fire-alarm circuits.

D. Performance Criteria:

1. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating is 20 kA, minimum.
2. Maximum Operating Current: 5 A, for NAC/PIV surge protectors; 1 A for SLC surge protectors.

2.15 120V FACP POWER CIRCUITS

- A. Furnish and install Surge Protective Devices (SPDs) on all nominal 120VAC electrical circuits that supply power to the main Fire Alarm Control Panel (FACP).
- B. SPD shall be Recognized or Listed to UL 1449 Fourth Edition, Surge Protective Devices.
- C. SPD shall be Recognized or Listed to UL 1283, EMI/RFI Filtering.
- D. SPD shall incorporate a series-wired design with replaceable surge protection module.
- E. SPD shall incorporate audible alarm notification, LED diagnostic status indicator, and a Form C contact terminal block for remote notification of protection status.
- F. The SCCR (short circuit current rating) of the SPD shall be equal to, or greater than, the AIC rating of the circuit breaker it is being fed from per NFPA 70, National Electrical Code, Article 285.6
- G. The SPD shall have a minimum Nominal Discharge Current (In) of 10 kA.
- H. The SPD shall provide all modes of protection based on the system voltage.
- I. The Voltage Protection Rating (VPRs) for each mode shall not exceed the following:
 - a. Line to Neutral (L-N): 700V
 - b. Line to Ground L-G): 700V
 - c. Neutral to Ground (N-G): 1200V
- J. SPD shall be self-restoring and fully automatic.
- K. Total Surge Current Rating shall be a minimum of 50 kA.
- L. Maximum Operating Current shall be at least 20 Amps.

2.16 FACP COMMUNICATION CENTER

- A. Furnish and install Surge Protective Devices (SPDs) on all telephone communication circuits, Ethernet circuits, or external wireless antenna

cables that wire directly into the Fire Alarm Control Panel or a separate Wireless Radio Communication Panel.

- B. SPD for telephone circuits shall be listed to UL 497A, Secondary Protectors for Communications Circuits.
- C. SPD for Ethernet circuits shall be listed to UL 497B, Protectors for Data Communications and Fire Alarm Circuits.
- D. SPD shall incorporate a series-wired design.
- E. Total Surge Current Rating shall be a minimum of 10 kA.

2.17 DATA & SIGNALING SYSTEM CIRCUITS

- A. Furnish and install Surge Protective Devices (SPDs) on all metallic data and signaling system circuits that leave the building per NFPA 72, National Fire Alarm and Signaling Code, Chapter 12 and NFPA 70, National Electrical Code, Article 760.32. These circuits include, but are not limited to, Signaling Line Circuit (SLC), Post Indicator Valve (PIV) monitoring circuit and Notification Appliance Circuit (NAC).
- B. SPD shall be listed to UL 497B, Protectors for Data Communications and Fire Alarm Circuits.
- C. SPD shall incorporate a series-wired design with replaceable surge protection module.
- D. SPD shall incorporate a multi-stage, hybrid design that utilizes at least two (2) different types of surge protection technology.
- E. Total Surge Current Rating shall be a minimum of 20 kA.
- F. Maximum Operating Current shall be at least 5 Amps for NAC/PIV Surge Protective Device.
- G. Maximum Operating Current shall be at least 1 Amp for SLC Surge Protective Device.

2.18 LOW VOLTAGE POWER CIRCUITS

- A. Furnish and install surge protection on all low voltage AC or DC power circuits that extend beyond the outer perimeter of the building structure.
- B. SPD for low voltage power circuits shall be listed to UL 497B.
- C. SPD shall incorporate a series-wired design.
- D. SPD shall be self-restoring and fully automatic.
- E. Total Surge Current Rating shall be a minimum of 20 kA.
- F. SPD shall be self-restoring and fully automatic.

2.19 ACCESS CONTROL DATA, POWER, AND ETHERNET CIRCUIT SURGE PROTECTIVE

DEVICES

- A. Source Limitations: Obtain devices from single source from single manufacturer.
- B. Provide surge protection on metallic data cabling, low-voltage power, and Ethernet cabling paths that extend beyond outer perimeter of building structure.
 - 1. When access control equipment is located away from building structure and wired by underground or aerial cabling between equipment and building, provide surge protection at each end of circuit.
 - 2. Provide SPD having series-wired design.
- D. Standards:
 - 1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 497B, for data communications and fire-alarm circuits.

2.20 DATA & SIGNALING CIRCUITS

- A. Furnish and install surge protection on all metallic signaling & data communication cabling paths that extend beyond the outer perimeter of the main building structure.
- B. Furnish and install surge protection at both ends of the circuit if the intrusion detection device is physically located away from the main building structure and utilizes burial or aerial cabling between the main building and the mounting location.
- C. SPD for data communication & signaling cabling shall be listed to the following standards: UL 497B.
- D. SPD shall incorporate a series-wired design.
- E. SPD shall be self-restoring and fully automatic.

2.21 IDENTIFICATION PRODUCTS

- A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.22 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over

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frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

2.23 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.24 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable:
 - a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
 - b. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - c. Use ropes made of nonmetallic material for pulling feeders.
 - d. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COR.
 - e. Pull in multiple cables together in a single conduit.
- C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
 1. Splices and terminations shall be mechanically and electrically secure.
 2. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.
- D. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to

supply such systems and have suitable spare circuit breakers or space for installation.

- H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.
- J. UTP Cable Installation:
 - 1. Comply with TIA/EIA-568-B.2.
 - 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- K. Optical Fiber Cable Installation:
 - 1. Comply with TIA/EIA-568-B.3.
 - 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- L. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm).
 - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- M. Installation of Cable Routed Exposed under Raised Floors:
 - 1. Install plenum-rated cable only.
 - 2. Install cabling after the flooring system has been installed in raised floor areas.
 - 3. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

N. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

O. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.2 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Division 28 Section CONDUITS AND BACKBOXES FOR ELECTRICAL SYSTEMS."
 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use

different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 CONTROL CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.4 CONNECTIONS

- A. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Division 28 Section "FIRE DETECTION AND ALARM" for connecting, terminating, and identifying wires and cables.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING."
- B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

3.7 INSTALLATION OF SURGE SUPPRESSION DEVICES

- A. Install Surge Protective Devices as shown on the Drawings and in accordance with manufacturer's installation instructions.
- B. The conductor wire length between the SPD and the equipment being protected shall be a minimum of 3 feet in length. The conductor wire length can be greater than 3 feet as long as they are isolated and are

not subjected or directly exposed to internally- or externally generated transient voltage spikes and/or surges.

- C. A standard multi-position grounding bus bar shall be used when terminating SPD ground wires to existing electrical grounding conductors. Twist-on wire connectors will not be accepted.
- D. When multiple SPDs are used, a dedicated ground wire shall be run from each individual SPD directly to a multi-position grounding bus bar. "Daisy-chaining" multiple SPD ground wires together via the SPD grounding terminals will not be accepted.
- E. The field wiring (unprotected wires) and the protected wiring shall occupy separate conduit feeds when entering and leaving the SPD enclosure.
- F. SPDs shall not be mounted inside of the Fire Alarm Control Panel.
- G. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
- H. Minimum Lead Length for Series-Wired SPDs: 3 ft. (915 mm).
- I. Provide continuous ground wire from SPD to ground bar with bolted lug connections. Spliced ground conductors are unacceptable.
 - 1. Do not connect ground wires from multiple SPD in series, daisy chain arrangement.
 - 2. Do not connect ground wires from multiple SPDs in daisy chain arrangement. Connect each SPD ground to common grounding bus bar.
- J. Install SPD in separate enclosure, outside equipment panel of system being protected.

3.8 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
- B. Install a permanent wire marker on each wire at each termination.
- C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- D. Wire markers shall retain their markings after cleaning.
- E. In each handhole, install embossed brass tags to identify the system served and function.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:

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1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.9 EXISTING WIRING

- A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

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SECTION 28 05 26
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 26 41 00 - FACILITY LIGHTNING PROTECTION. Requirements for a lightning protection system.
- C. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.
- D. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.
- E. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning.

1.3 SUBMITTALS

- A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
- B. Shop Drawings:
 - 1. Clearly present enough information to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Engineer of Record and VA COTR:
 - 1. Certification that the materials and installation are in accordance with the drawings and specifications.

2. Certification by the contractor that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
 - B1-2013R18.....Standard Specification for Hard-Drawn Copper Wire
 - B3-2013R18.....Standard Specification for Soft or Annealed Copper Wire
 - B8-2011R17.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 81-2012.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
 - C2-2017.....National Electrical Safety Code
- D. National Fire Protection Association (NFPA):
 - 70-2023.....National Electrical Code (NEC)
 - 99-2024.....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
 - 44-2018 Thermoset-Insulated Wires and Cables
 - 83-2017 Thermoplastic-Insulated Wires and Cables
 - 467-2013 Grounding and Bonding Equipment
 - 486A-486B-2018 Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

2.2 GROUND RODS

- A. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).2.4 ground connections
- B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- C. Below Grade: Exothermic-welded type connectors.
- D. Above Grade:
 - 1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
 - 2. Connection to Building Steel: Exothermic-welded type connectors.
 - 3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
 - 4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
 - 5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - a) Pipe Connectors: Clamp type, sized for pipe.
 - 6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 EQUIPMENT RACK AND CABINET GROUND BARS

- A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8-inch x ¾ inch).

2.5 GROUND TERMINAL BLOCKS

- A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.6 SPLICE CASE GROUND ACCESSORIES

- A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

- A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 CORROSION INHIBITORS

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.4 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 WIREWAY GROUNDING

- A. Ground and Bond Metallic Wireway Systems as follows:
 - 1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
 - 2. Install insulated 16 mm² (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest

building ground at each end and approximately every 16 meters (50 feet).

3. Use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
4. Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.6 LIGHTNING PROTECTION SYSTEM

- A. Bond the lightning protection system to earth ground externally to the building. Under no condition shall the electrical system's third of fourth ground electrode system, or the telecommunications system circulating ground system be connected to the lightning protection system. The Facility's structural steel may be used to connected the lightning protection system at the direction of the Engineer of Record certified by an independent certified grounding contractor.

3.7 EXTERIOR LIGHT/CAMERA POLES

- A. Provide 20 ft [6.1 M] of No. 4 bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.8 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Services at power company interface points shall comply with the power company ground resistance requirements.

- D. Below-grade connections shall be visually inspected by the Engineer of Record and the VA COTR prior to backfilling. The contractor shall notify the Engineer of Record and VA COTR 24 hours before the connections are ready for inspection.

3.9 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.10 GROUNDING FOR RF/EMI CONTROL

- A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 100 mm (4 inches) wide copper strip or two 6 mm² (10 AWG) copper conductors spaced minimum 100 mm (4 inches) apart. Use 16 mm² (6 AWG) copper where exposed and subject to damage.
- B. Comply with the following when shielded cable is used for data circuits.
1. Shields shall be continuous throughout each circuit.
 2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
 3. Do not connect shields from different circuits together.
 4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

3.11 LABELING

- A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).
2. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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SECTION 28 05 28.33
CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 06 10 00 - ROUGH CARPENTRY. Requirements for mounting board for communication closets.
- C. Section 07 84 00 - FIRESTOPPING. Requirements for sealing around penetrations to maintain the integrity of fire rated construction.
- D. Section 07 60 00 - FLASHING AND SHEET METAL. Requirements for fabrications for the deflection of water away from the building envelope at penetrations.
- E. Section 07 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- F. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.
- G. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.
- H. Section 28 05 13 - CONDUCTORS AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

- I. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.
- I. Section 28 31 00 - FIRE DETECTION AND ALARM. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc.
- K. Section 31 20 00 - EARTH MOVING. For bedding of conduits.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

- A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

1.5 SUBMITTALS

- A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:
- B. Shop Drawings:
 - 1. Size and location of main feeders.
 - 2. Size and location of panels and pull boxes
 - 3. Layout of required conduit penetrations through structural elements.
 - 4. The specific item proposed, and its area of application shall be identified on the catalog cuts.

- C. Certification: Prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.
- D. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- E. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- F. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. Custom enclosures and cabinets.
 2. Handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- G. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Structural members in the paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- H. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure

characteristics, including its interior accessibility, after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

I. Source quality-control test reports.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Electrical Manufacturers Association (NEMA):

TC-3-21.....PVC Fittings for Use with Rigid PVC Conduit and
Tubing

FB1-14.....Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

C. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-16.....Surface Metal Raceway and Fittings

6-07.....Rigid Metal Conduit

50-15.....Enclosures for Electrical Equipment

360-13.....Liquid-Tight Flexible Steel Conduit

467-13.....Grounding and Bonding Equipment

514A-17.....Metallic Outlet Boxes

514B-12.....Fittings for Cable and Conduit

514C-14.....Nonmetallic Outlet Boxes, Flush-Device Boxes
and Covers

651-11.....Schedule 40 and 80 Rigid PVC Conduit

651A-11.....Type EB and A Rigid PVC Conduit and HDPE
Conduit

797-14.....Electrical Metallic Tubing

1242-06.....Intermediate Metal Conduit

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conduit Size: In accordance with the NEC, but not less than 20 mm (3/4 inch) unless otherwise shown.

2.2. CONDUIT

- A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
- B. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
- C. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
- D. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.
- E. Flexible galvanized steel conduit: Shall Conform to UL 1.
- F. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

2.3. WIREWAYS AND RACEWAYS

- A. Surface metal raceway: Shall Conform to UL 5.

2.4. CONDUIT FITTINGS

- A. Rigid steel and IMC conduit fittings:
 - 1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 - 2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
 - 3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - 4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - 5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - 6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates

having the same finishes as that of other electrical plates in the room.

B. Rigid aluminum conduit fittings:

1. 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 prohibited.
2. Locknuts and bushings: As specified for rigid steel and IMC conduit.
3. Set screw fittings: Not permitted for use with aluminum conduit.

C. Electrical metallic tubing fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
4. Indent type connectors or couplings are prohibited.
5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

D. Flexible steel conduit fittings:

1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Clamp type, with insulated throat.

E. Liquid-tight flexible metal conduit fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

F. Surface metal raceway fittings: As recommended by the raceway manufacturer.

G. Expansion and deflection couplings:

1. Conform to UL 467 and UL 514B.
2. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.

3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.5 CONDUIT SUPPORTS

- A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
- B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
- C. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
- D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.6 OUTLET, JUNCTION, AND PULL BOXES

- A. UL-50 and UL-514A.
- B. Cast metal where required by the NEC or shown and equipped with rustproof boxes.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- E. Sheet metal boxes: Galvanized steel, except where otherwise shown.
- F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

2.7 CABINETS

- A. NEMA 250, Type 12, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
- B. Hinged door in front cover with flush latch and concealed hinge.
- C. Key latch to match panelboards.
- D. Metal barriers to separate wiring of different systems and voltage.
- E. Accessory feet where required for freestanding equipment.

2.8 WIREWAYS

- A. Equip with hinged covers, except where removable covers are shown.

2.9 WARNING TAPE

- A. Standard, 4-Mil polyethylene 76 mm (3 inches) wide tape non-detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW".

2.10 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
 - 1. Color of Frame and Cover: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, as indicated for each service.
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 7. Handholes 300 mm wide by 600 mm long (2 inches wide by 24 inches long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.11 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 84 00 "FIRESTOPPING."

2.12 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.13 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 PENETRATIONS

- A. Cutting or Holes:
1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COR prior to drilling through structural sections.
 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COR as required by limited working space.
- B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, "JOINT SEALANTS".

3.2 INSTALLATION, GENERAL

- A. Install conduit as follows:
1. In complete runs before pulling in cables or wires.

2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
 3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
 4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
 5. Mechanically continuous.
 6. Independently support conduit at 2.4 m (8 foot) on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
 7. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
 8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
 9. Conduit installations under fume and vent hoods are prohibited.
 10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
 11. Do not use aluminum conduits in wet locations.
 12. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors, and ceilings.
- B. Conduit Bends:
1. Make bends with standard conduit bending machines.
 2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
 3. Bending of conduits with a pipe tee or vise is prohibited.
- C. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown.
 2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.
- D. Fire Alarm:
1. Fire alarm conduit shall be painted red (a red "top-coated" conduit from the conduit manufacturer may be used in lieu of painted

conduit) in accordance with the requirements of Section 28 31 00,
"FIRE DETECTION AND ALARM".

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:
 - a. Where shown on the structural drawings.
 - b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inch) thick is prohibited.
 - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
 - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
 - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 volts:
 - a. Rigid steel or rigid aluminum.
 - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
 - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 volts and below:
 - 1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- F. Surface metal raceways: Use only where shown.
- G. Painting:
 - 1. Paint exposed conduit as specified in Section 09 91 00, "PAINTING".
 - 2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, "PAINTING" for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit.

Flexible conduit shall have a copper green ground bonding jumper installed.

3.6 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. Existing Construction:
 - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
 - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for

cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. 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.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes).
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example, "SIG-FA JB No. 1".
- G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT

- A. Install the electronic safety and security raceway system as shown on drawings.
- B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90-degree bends. Size boxes per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

- H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90-degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
$\frac{3}{4}$	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)

- J. Furnish and install 19 mm (3/4 inch) thick fire-retardant plywood specified in on the wall of communication closets where shown on drawings. Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.
- K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

3.9 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - "COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS" for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00, "COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS" and related sections for contractor responsibilities for system commissioning.

VA Atlanta TVDD 12 Bed CLC
Contract #36C77622R0059
Carrollton GA 30117

Project #508-349

09-11

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SECTION 28 08 00

COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 28.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

- A. This Section includes requirements for commissioning the Facility electronic safety and security systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.
- B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in Division 28 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 28, is required in cooperation with the VA and the Commissioning Agent.
- B. The Facility exterior closure systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

- A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

- A. Commissioning of Electronic Safety and Security systems will require inspection of individual elements of the electronic safety and security systems throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule electronic safety and security systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the

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type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 28 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. The 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. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the COR. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

- A. Training of the VA operation and maintenance personnel is required in cooperation with the COR and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the VA COR after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING

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REQUIREMENTS and Division 28 Sections for additional Contractor
training requirements.

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**SECTION 28 13 00
PHYSICAL ACCESS CONTROL SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing and certification of a complete and fully operating Physical Access Control System, hereinafter referred to as the PACS.
- B. This Section includes a Physical Access Control System consisting of a system server, [one or more networked workstation computers,] operating system and application software, and field-installed Controllers connected by a high-speed electronic data transmission network. The PACS shall have the following:
 - 1. Physical Access Control:
 - a. Regulating access through doors
 - c. Surge and tamper protection
 - d. Credential cards and readers
 - 2. Security:
 - a. Video and camera control.
- C. PACS shall provide secure and reliable identification of Federal employees and contractors by utilizing credential authentication per FIPS-201.
- D. Physical Access Control System (PACS) shall consist of:
 - 1. Card readers,
 - 2. Door locks and sensors,
 - 3. Power supplies,
 - 4. Interfaces with:
 - a. Video Surveillance and Assessment System,
 - b. Fire Protection System,

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.
- D. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- E. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

- F. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- G. Section 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
- H. Section 26 05 41 - UNDERGROUND ELECTRICAL CONSTRUCTION. Requirements for underground installation of wiring.
- I. Section 26 56 00 - EXTERIOR LIGHTING. Requirements for perimeter lighting.
- J. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general requirements that are common to more than one section in Division 28.
- K. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- L. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- M. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- N. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY. For requirements for commissioning, systems readiness checklists, and training.
Requirements for control and operation of all security systems.
- O. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.
- P. Section 28 31 00 - FIRE DETECTION AND ALARM. Requirements for integration with fire detection and alarm system.

1.3 QUALITY ASSURANCE

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.4 SUBMITTALS

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.5 APPLICABLE PUBLICATIONS

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.6 DEFINITIONS

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.7 COORDINATION

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.8 MAINTENANCE & SERVICE

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.9 PERFORMANCE REQUIREMENTS

- A. PACS shall provide support for multiple authentication modes and bidirectional communication with the reader. PACS shall provide implementation capability for enterprise security policy and incident response.
- B. All processing of authentication information must occur on the "safe side" of a door
- C. Physical Access Control System shall provide access to following Security Areas:
 - 1. Controlled
 - 2. Limited
 - 3. Exclusion
- D. PACS shall provide:
 - 1. One authentication factor for access to Controlled security areas
 - 2. Two authentication factors for access to Limited security areas
 - 3. Three authentication factors for access to Exclusion security areas
- E. PACS shall provide Credential Validation and Path Validation per NIST 800-116.
- F. The PACS System shall have an Enterprise Path Validation Module (PVM) component that processes X.509 certification paths composed of X.509 v3 certificates and X.509 v2 CRLs. The PVM component MUST support the following features:
 - 1. Name chaining;
 - 2. Signature chaining;
 - 3. Certificate validity;
 - 4. Key usage, basic constraints, and certificate policies certificate extensions;
 - 5. Full CRLs; and
 - 6. CRLs segmented on names.
- G. Distributed Processing: System shall be a fully distributed processing system so that information, including time, date, valid codes, access

levels, and similar data, is downloaded to Controllers so that each Controller makes access-control decisions for that Location. Do not use intermediate Controllers for physical access control. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

H. Data Capacity:

1. [130] different card-reader formats.

I. Location Capacity:

1. [128] reader-controlled doors.
2. [50,000] total access credentials.

1.10 EQUIPMENT AND MATERIALS

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.11 WARRANTY OF CONSTRUCTION.

- A. Warrant PACS work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.
- B. Demonstration and training shall be performed prior to system acceptance.

1.12 GENERAL REQUIREMENTS

- A. For general requirements that are common to more than one section in Division 28 refer to Section 28 05 00, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.
- B. General requirements applicable to this section include:
 1. General Arrangement Of Contract Documents,
 2. Delivery, Handling and Storage,
 3. Project Conditions,
 4. Electrical Power,
 5. Lightning, Power Surge Suppression, and Grounding,
 6. Electronic Components,
 7. Substitute Materials and Equipment, and
 8. Like Items.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and materials for the system will be compatible to ensure correct operation as outlined in FIPS 201, March 2006 and HSPD-12.
- B. The security system characteristics listed in this section will serve as a guide in selection of equipment and materials for the PACS. If updated or more suitable versions are available then the Contracting Officer will approve the acceptance of prior to an installation.
- C. PACS equipment shall meet or exceed all requirements listed below.
- D. A PACS shall be comprised of, but not limited to, the following components:
 - 1. Physical Access Control System
 - 4. Surge and Tamper Protection
 - 2. Card Readers
 - 3. Video and Camera Control
 - 4. Cables
 - 5. Transformers

2.2 SURGE AND TAMPER PROTECTION

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

2.3 CARD READERS

- A. Power: Card reader shall be powered from its associated Controller, including its standby power source.
- B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be [800]ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- C. Enclosure: Suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - 1. Indoors, controlled environment.
 - 2. Indoors, uncontrolled environment.
 - 3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

- D. Display: LED or other type of visual indicator display shall provide visual status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
- E. Shall be utilized for controlling the locking hardware on a door and allows for reporting back to the main control panel with the time/date the door was accessed, the name of the person accessing the point of entry, and its location.
- F. Will be fully programmable and addressable, locally and remotely, and hardwired to the system.
- G. Shall be individually home run to the main panel.
- H. Shall be installed in a manner that they comply with:
 - 1. The Uniform Federal Accessibility Standards (UFAS)
 - 2. The Americans with Disabilities Act (ADA)
 - 3. The ADA Standards for Accessible Design
- I. Shall support a variety of card readers that must encompass a wide functional range. The PACS may combine any of the card readers described below for installations requiring multiple types of card reader capability (i.e., card only, card and/or PIN, card and/or biometrics, card and/or pin and/or biometrics, supervised inputs, etc.). These card readers shall be available in the approved technology to meet FIPS 201, and is ISO 14443 A or B, ISO/IEC 7816 compliant. The reader output can be Wiegand, RS-22, 485 or TCP/IP.
- J. Shall be housed in an aluminum bezel with a wide lead-in for easy card entry.
- K. Shall contain read head electronics, and a sender to encode digital door control signals.
- L. LED's shall be utilized to indicate card reader status and access status.
- M. Shall be able to support a user defined downloadable off-line mode of operation (e.g. locked, unlocked), which will go in effect during loss of communication with the main control panel.
- N. Shall provide audible feedback to indicate access granted/denied decisions. Upon a card swipe, two audible tones or beeps shall indicate access granted and three tones or beeps shall indicate access denied. All keypad buttons shall provide tactile audible feedback.

- O. Shall have a minimum of two programmable inputs and two programmable outputs.
- P. All card readers that utilize keypad controls along with a reader and shall meet the following specifications:
 - 1. Entry control keypads shall use a unique combination of alphanumeric and other symbols as an identifier. Keypads shall contain an integral alphanumeric/special symbols keyboard with symbols arranged in ascending ASCII code ordinal sequence. Communications protocol shall be compatible with the local processor.
- Q. Shall include a Light Emitting Diode (LED) or other type of visual indicator display and provide visual or visual and audible status indications and user prompts. The display shall indicate power on/off, and whether user passage requests have been accepted or rejected. The design of the keypad display or keypad enclosure shall limit the maximum horizontal and vertical viewing angles of the keypad. The maximum horizontal viewing angle shall be plus and minus five (5) degrees or less off a vertical plane perpendicular to the plane of the face of the keypad display. The maximum vertical viewing angle shall be plus and minus 15 degrees or less off a horizontal plane perpendicular to the plane of the face of the keypad display.
 - 1. Shall respond to passage requests by generating a signal to the local processor. The response time shall be 800 milliseconds or less from the time the last alphanumeric symbol is entered until a response signal is generated.
 - 2. Shall be powered from the source as designed and shall not dissipate more than 150 Watts.
 - 3. Shall be suitable for surface, semi-flush, pedestal, or weatherproof mounting as required.
 - 4. Shall provide a means for users to indicate a duress situation by entering a special code.
- R. PIV Contact Card Reader
 - 1. Application Protocol Data Unit (APDU) Support: At a minimum, the contact interface shall support all card commands for contact based access specified in Section 7, End-point PIV Card Application Card Command Interface of SP 800-73-1, Interfaces for Personal Identity Verification.

2. Buffer Size: The reader must contain a buffer large enough to receive the maximum size frame permitted by International Organization for Standardization International Electrotechnical Commission (ISO/IEC) 7816-3:1997, Section 9.4.
3. Programming Voltage: PIV Readers shall not generate a Programming Voltage.
4. Support for Operating Class: PIV Readers shall support cards with Class A Vccs as defined in ISO/IEC 7816-3:1997 and ISO/IEC 7816-3:1997/Amd 1:2002.
5. Retrieval Time: Retrieval time¹ for 12.5 kilobytes (KB) of data through the contact interface of the reader shall not exceed 2.0 seconds.
6. Transmission Protocol: The PIV Reader shall support both the character-based T=0 protocol and block-based T=1 protocol as defined in ISO/IEC 7816-3:1997.
7. Support for PPS Procedure: The reader shall support Protocol and Parameters Selection (PPS) procedure by having the ability to read character TA1 of the Answer to Reset (ATR) sent by the card as defined in ISO/IEC 7816-3:1997.

S. Contactless Smart Cards and Readers

1. Smart card readers shall read credential cards whose characteristics of size and technology meet those defined by ISO/IEC 7816, 14443, 15693.
2. The readers shall have "flash" download capability to accommodate card format changes.
3. The card reader shall have the capability of reading the card data and transmitting the data to the main monitoring panel.
4. The card reader shall be contactless and meet or exceed the following technical characteristics:
 - a. Data Output Formats: FIPS 201 low outputs the FASC-N in an assortment of Wiegand bit formats from 40 - 200 bits. FIPS 201 medium outputs a combination FASC-N and HMAC in an assortment of Wiegand bit formats from 32 - 232 bits. All Wiegand formats or the upgradeability from Low to Medium Levels can be field configured with the use of a command card.

- b. FIPS 201 readers shall be able to read, but not be limited to, DESfire and iCLASS cards.
- c. Reader range shall comply with ISO standards 7816, 14443, and 15693, and also take into consideration conditions, are at a minimum 1" to 2" (2.5 - 5 cm).
- d. APDU Support: At a minimum, the contactless interface shall support all card commands for contactless based access specified in Section 7, End-point PIV Card Application Card Command Interface of SP 800-73-1, Interfaces for Personal Identity Verification.
- e. Buffer Size: The reader shall contain a buffer large enough to receive the maximum size frame permitted by ISO/IEC 7816-3, Section 9.4.
- f. ISO 14443 Support: The PIV Reader shall support parts (1 through 4) of ISO/IEC 14443 as amended in the References of this publication.
- g. Type A and B Communication Signal Interfaces: The contactless interface of the reader shall support both the Type A and Type B communication signal interfaces as defined in ISO/IEC 14443-2:2001.
- h. Type A and B Initialization and Anti-Collision The contactless interface of the reader shall support both Type A and Type B initialization and anti-collision methods as defined in ISO/IEC 14443-3:2001.
- i. Type A and B Transmission Protocols: The contactless interface of the reader shall support both Type A and Type B transmission protocols as defined in ISO/IEC 14443-4:2001.
- j. Retrieval Time: Retrieval time for 4 KB of data through the contactless interface of the reader shall not exceed 2.0 seconds.
- k. Transmission Speeds: The contactless interface of the reader shall support bit rates of fc/128 (~106 kbits/s), fc/64 (~212 kbits/s), and configurable to allow activation/deactivation.
- l. Readability Range: The reader shall not be able to read PIV card more than 10cm(4inch) from the reader

2.4 WIRES AND CABLES

- A. Refer to section 280513 "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY".

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall install all system components and appurtenances in accordance with the manufacturers' instructions, ANSI C2, and shall furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signals, communications, and data transmission lines grounding shall be installed as necessary to preclude ground loops, noise, and surges from affecting system operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with manufacturers' recommendations and as modified herein.
- B. Consult the manufacturers' installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all schematic system installation/termination/wiring data.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., sensors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

3.2 CURRENT SITE CONDITIONS

- A. The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions which will affect performance of the system to the Owner in a report as defined in paragraph Group II Technical Data Package. The Contractor shall not take any corrective action without written permission from the Owner.

3.3 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
 - 1. Record setup data for control station and workstations.
 - 2. For each Location, record setup of Controller features and access requirements.
 - 3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 - 4. Set up groups, linking, and list inputs and outputs for each Controller.
 - 5. Assign action message names and compose messages.
 - 6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 - 7. Prepare and install alarm graphic maps.
 - 8. Develop user-defined fields.
 - 9. Develop screen layout formats.
 - 10. Propose setups for guard tours and key control.
 - 11. Discuss badge layout options; design badges.
 - 12. Complete system diagnostics and operation verification.
 - 13. Prepare a specific plan for system testing, startup, and demonstration.
 - 14. Develop acceptance test concept and, on approval, develop specifics of the test.
 - 15. Develop cable and asset management system details; input data from construction documents. Include system schematics and Technical Drawings.
- D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.5 CABLING

- A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

- B. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- D. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and that ensure Category 5E performance of completed and linked signal paths, end to end.
- E. Install cables without damaging conductors, shield, or jacket.
- F. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- G. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.6 INSTALLATION

- A. System installation shall be in accordance with UL 294, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.4 and 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a operable system.
- D. The PACS will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a network.

- E. For integration purposes, the PACS shall be integrated where appropriate with the following associated security subsystems:
1. CCTV:
 - a. Provide 24 hour coverage of all entry points to the perimeter and agency buildings. As well as all emergency exits utilizing a fixed color camera.
 - b. Be able to monitor, control and record cameras on a 24 hours basis.
 - c. Be programmed automatically call up a camera when an access point is but into an alarm state.
 - d. For additional PACS system requirements as they relate to the CCTV, refer to Section 28 23 00, VIDEO SURVEILLANCE.
 - F. The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system. The Contractor shall not take any corrective action without written permission from the Government.
 - G. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.
 - H. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.
 - I. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.
 - J. Card Readers:

1. Connect all signal inputs and outputs as shown and specified.
2. Terminate input signals as required.
3. Program and address the reader as per the design package.
4. Readers shall be surface or flushed mounted and all appropriate hardware shall be provided to ensure the unit is installed in an enclosed conduit system.

K. Supplemental Contractor Quality Control:

1. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed PACS; and are approved by the Contracting Officer.
2. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.
3. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.
4. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

3.7 SYSTEM SOFTWARE

- A. Install, configure, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:
- B. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3.9 PROTECTION

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that

have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.10 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.11 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- C. Develop separate training modules for the following:
 - 1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
 - 2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
 - 3. Security personnel.
 - 4. Hardware maintenance personnel.
 - 5. Corporate management.
- D. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 28 16 00
INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and install a complete Intrusion Detection System, hereinafter referred to as IDS, as specified in this section.
- B. This Section includes the following:
 - 1. Intrusion detection with [hard-wired] [multiplexed], modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.
 - 2. Responsibility for integrating electronic and electrical systems and equipment is specified in the following Sections, with Work specified in this Section:
 - a. Division 08 Section "DOOR HARDWARE".
 - b. Division 27 Section "INTERCOMMUNICATIONS AND PROGRAM SYSTEMS".
 - c. Division 28 Section "PHYSICAL ACCESS CONTROL".
 - d. Division 28 Section "FIRE DETECTION AND ALARM".
 - e. Division 28 Section "VIDEO SURVEILLANCE".
- C. Related Sections include the following:
 - 1. Division 28 Section "VIDEO SURVEILLANCE" for closed-circuit television cameras that are used as devices for video motion detection.
 - 2. Division 28 Section "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY" for cabling between central-station control units and field-mounted devices and controllers.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- D. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- E. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

- F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- I. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY. Requirements for commissioning - systems readiness checklists, and training.
- J. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEMS (PACS). Requirements for physical access control integration.
- K. Section 28 13 16 - ACCESS CONTROL SYSTEM AND DATABASE MANAGEMENT. Requirements for control and operation of all security systems.
- L. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.
- M. Section 28 26 00 - ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS). Requirements for emergency and interior communications.
- N. Section 28 31 00 - FIRE DETECTION AND ALARM. Requirements for integration with fire detection and alarm system.

1.3 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the IDS as shown. The Contractor shall also provide certification as required.
- B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

1.4 DEFINITIONS

- A. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
- B. I/O: Input/Output.

- C. Intrusion Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.
- D. LED: Light-emitting diode.
- E. NEC: National Electric Code
- F. NEMA: National Electrical Manufacturers Association
- G. NFPA: National Fire Protection Association
- H. NRTL: Nationally Recognized Testing Laboratory.
- I. SMS: Security Management System - A SMS is software that incorporates multiple security subsystems (e.g., physical access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.
- J. PIR: Passive infrared.
- K. RF: Radio frequency.
- L. Standard Intruder: A person who weighs 45 kg (100 lb.) or less and whose height is 1525 mm (60 in) or less; dressed in a long-sleeved shirt, slacks, and shoes.
- M. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
- N. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- O. UPS: Uninterruptible Power Supply
- P. UTP: Unshielded Twisted Pair

1.5 SUBMITTALS

- A. Refer to Section 28 05 00, Part1
 - A. Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 02 41 00, DEMOLITION.
 - B. Provide certificates of compliance with Section 1.3, Quality Assurance.
 - C. Provide a shop drawing and as-built design package in both electronic format and on paper, minimum size 1220 x 1220 millimeters (48 x 48 inches); drawing submittals shall be per the established project schedule.

D. Shop drawing and as-built packages shall include, but not be limited to:

1. Index Sheet that shall:
 - a. Define each page of the design package to include facility name, building name, floor, and sheet number.
 - b. Provide a list of all security abbreviations and symbols.
 - c. Reference all general notes that are utilized within the design package.
 - d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:
 - a. Include a title block as defined above.
 - b. Define the drawings scale in both standard and metric measurements.
 - c. Provide device identification and location.
 - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
 - e. Identify all pull box and conduit locations, sizes, and fill capacities.
 - f. Address all general and drawing specific notes for a particular drawing sheet.
3. A riser drawing for each applicable security subsystem shall:
 - a. Indicate the sequence of operation.
 - b. Relationship of integrated components on one diagram.
 - c. Include the number, size, identification, and maximum lengths of interconnecting wires.
 - d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the

manufacturer's name and part number for the wire/cable being installed.

4. A system drawing for each applicable security system shall:
 - a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
 - b. Provide full detail of all system components wiring from point-to-point.
 - c. Identify wire types utilized for connection, interconnection with associate security subsystems.
 - d. Show device locations that correspond to the floor plans.
 - e. All general and drawing specific notes shall be included with the system drawings.
5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
 - a. Device ID.
 - b. Device Location (e.g. site, building, floor, room number, location, and description).
 - c. Mounting type (e.g. flush, wall, surface, etc.).
 - d. Power supply or circuit breaker and power panel number.
 - e. In addition, for the IDS, provide the sensor ID, sensor type and housing model number.
6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Shop drawing packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
 1. 35 percent
 2. 65 percent
 3. 90 percent
 4. 100 percent
- F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.

- G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.
- H. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Security Industry Association (SIA):
 - PIR-01-00.....Passive Infrared Motion Detector Standard -
Features for Enhancing False Alarm Immunity
 - CP-01-00.....Control Panel Standard-Features for False Alarm
Reduction
- C. Department of Justice American Disability Act (ADA)
 - 28 CFR Part 36.....2010 ADA Standards for Accessible Design
- D. Federal Communications Commission (FCC):
 - (47 CFR 15) Part 15.....Limitations on the Use of Wireless
Equipment/Systems
- E. National Electrical Manufacturers Association (NEMA):
 - 250-2018.....Enclosures for Electrical Equipment (1000 Volts
Maximum)
- F. National Fire Protection Association (NFPA):
 - 70-2023.....National Electrical Code
 - 731-2023.....Standards for the Installation of Electric
Premises Security Systems
- G. Underwriters Laboratories, Inc. (UL):
 - 464-2023.....Audible Signal Appliances
 - 609-2022.....Local Burglar Alarm Units and Systems
 - 634-2020.....Standards for Connectors with Burglar-Alarm
Systems

639-2019.....Standards for Intrusion Detection Units
 1037-2023.....Standard for Anti-theft Alarms and Devices
 1635-2018.....Digital Alarm Communicator System Units

H. Uniform Federal Accessibility Standards (UFAS), 19841.

1.7 COORDINATION

- A. Coordinate arrangement, mounting, and support of intrusion detection system equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.8 EQUIPMENT AND MATERIALS

- A. General
 - 1. All equipment associated within the IDS shall be rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.
 - 2. All equipment shall operate on low-voltage as designed by the security vendor.
 - 3. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.
 - 4. All IDS components located in designated "HAZARDOUS ENVIRONMENT" areas where fire or explosion could occur due to the presence of

natural gases or vapors, flammable liquids, combustible residue, or ignitable fibers or debris, shall be rated Class II, Division I, Group F, and installed in accordance with National Fire Protection Association (NFPA) 70 National Electric Code, Chapter 5.

5. All equipment and materials for the system will be compatible to ensure functional operation in accordance with requirements.

1.9 WARRANTY OF CONSTRUCTION.

- A. Warrant IDS work subject to the Article "Warranty of Construction" of FAR 52.246-21.
- B. Demonstration and training shall be performed prior to system acceptance.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
 1. Alarm Signal: Display at central-station control unit and actuate audible and visual alarm devices.
 2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
 3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.
- B. System Control: Central-station control unit shall directly monitor intrusion detection units and connecting wiring.
- C. System Control: Central-station control unit shall directly monitor intrusion detection devices /, perimeter detection units,/ /, controllers associated with perimeter detection units,/ and connecting

wiring in a multiplexed distributed control system or as part of a network.

D. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

E. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.
7. Print Reports.

F. Timed Control at Central-Station Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

G. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:

1. Switch selected lights.
2. Shift elevator control to a different mode.
3. Open a signal path between certain intercommunication stations.
4. Shift sound system to "listening mode" and open a signal path to certain system speakers.
5. Switch signal to selected monitor from closed-circuit television camera in vicinity of sensor signaling an alarm.

H. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When central-station control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.

I. Response Time: 2 seconds between actuation of any alarm and its indication at central-station control unit.

J. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from central-station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at central-station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

K. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

L. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Compatibility: Detection devices and their communication features, connecting wiring, and central-station control unit shall be selected

and configured with accessories for full compatibility with the following equipment:

1. Data Gathering Panel, Output Module, Input Module, 28 13 00 PHYSICAL ACCESS CONTROL SYSTEM.
- B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS.
 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements in Division 26 Section TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS as recommended by manufacturer for type of line being protected.
- C. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V RMS injected into power supply lines at 10 to 10,000 MHz.
- D. Tamper Protection: Tamper switches on detection devices, controllers, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Central-station control-unit alarm display shall identify tamper alarms and indicate locations.
- E. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to central-station control unit.
- F. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational

dysfunction. Devices transmit detection of operational dysfunction to central-station control unit as an alarm signal.

- G. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to central-station control unit.

2.3 ENCLOSURES

- A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.
- B. Interior Electronics: NEMA 250, Type 12.
- C. Exterior Electronics: NEMA 250, Type 4X [fiberglass] [stainless steel].
- D. Corrosion Resistant: NEMA 250, Type 4X [PVC] [stainless steel].
- E. Screw Covers: Where enclosures are accessible to inmates, secure with security fasteners of type appropriate for enclosure.

2.5 EQUIPMENT ITEMS

- A. General:
1. All requirements listed below are the minimum specifications that need to be met in order to comply with the IDS.
 2. All IDS sensors shall conform to UL 639, Intrusion Detection Standard.
 3. Ensure that IDS is fully integrated with other security subsystems as required to include, but not limited to, the CCTV, PACS, EPPS, and Physical Access Control System and Database Management. The IDS provided shall not limit the expansion and growth capability to a single manufacturer and shall allow modular expansion with minimal equipment modifications.
- B. IDS Components: The IDS shall consist of, but not be limited to, the following components:
1. Control Panel
 2. Exterior Detection Devices (Sensors)
 3. Interior Detection Devices (Sensors)
 4. Power Supply
 5. Enclosures

2.6 CONTROL PANEL

- A. The Control panel shall be the main point of programming, monitoring, accessing, securing, and troubleshooting the IDS. Refer to American

National Standards Institute (ANSI) CP-01 Control Panel Standard-Features for False Alarm Reduction.

- B. The Control Panel shall provide a means of reporting alarms to an Physical Access Control System and Database Management via a computer interface or direct connection to an alarm control monitoring panel.
- C. The Control panel shall utilize a Multifunctional Keypad, Input and Output Modules for expansion of alarm zones, interfacing with additional security subsystems, programming, monitoring and controlling the IDS.
- D. The Control panel shall meet or exceed the following minimum functional requirements for programming outputs, system response, and user interface:
 - 1. Programming Outputs:
 - a. 2 Amps alarm power at 12 VDC
 - b. 1.4 Amps auxiliary power at 12 VDC
 - c. Four alarm output patterns
 - d. Programmable bell test
 - e. Programmable bell shut-off timer
 - 2. System Response:
 - a. Selectable point response time
 - b. Cross point capability
 - c. Alarm verification
 - d. Watch mode
 - e. Scheduled events arm, disarm, bypass and un-bypass points, control relays, and control authority levels
 - 3. User Interface:
 - a. Supervises up to eight command points (e.g. Up to 16 unsupervised keypads can be used)
 - b. Provides custom keypad text
 - c. Addresses full function command menu including custom functions
 - d. Allows user authority by defined area and 16-character name
 - e. Provides for 14 custom authority control levels allowing user's authority to change, add, delete pass codes, disarm, bypass points, and start system tests.
 - 4. The Control panel shall meet or exceed the following technical characteristics:

Input Voltage via 110 VAC or 220 VAC Step-down	16 or 18 VAC

Transformer	
Operating Voltage	12 VDC
Output Voltage	12 VDC @ 2 A max
Direct Hardwire Zones	7
Partitions	8
Multifunctional Keypads	16 (2 per partition)
Communications Port	RJ-11

E. A multifunctional keypad shall be utilized as a user interface for arming, disarming, monitoring, troubleshooting, and programming the alarm control panel.

F. Keypads shall have the following features:

1. Multiple function keypads suitable for remote mounting, no greater than 1333 m (4000 ft), shall be provided from the control panel and have a light emitting diode (LED) readout of alarm and trouble conditions by zone.
2. An alphanumeric English language display, with keypad programmability, and EE-PROM memory, shall also be provided.
3. Trouble alarm indicators shall be distinguishable from intrusion alarms.
4. A minimum of four (4) zones selectable as entry and exit with programmable time delay.
5. Complete system test activated capability at the keypad.
6. Capability for opening and closing reports to a remote monitoring location.
7. Adjustable entry and exit delay times.
8. Capability for a minimum of two (2) multiple function keypads.
9. Capability to shunt or bypass selected interior zones while arming perimeter protection and remaining interior zones.
10. Capability for a minimum of seven assignable pass-codes that are keypad programmable from a suppressed master code.
11. The control panel shall have a communications port that will allow for communications with a computer for programming, monitoring, and troubleshooting purposes. The communications port will be, at a minimum, and RJ-11 or better.
12. The control panel will have a systems success probability of 95% or better, and shall include the following success considerations:

- a. False Alarm: Shall not exceed one (1) false alarm per 30 days per sensor zone.
 - b. Nuisance Alarm: Shall not exceed a rate of one (1) alarm per seven (7) days per zone within the first 60 days after installation and acceptance. Sensor adjustments will be made and then shall not exceed one (1) alarm per 30 days.
13. The Control Panel will be able to detect either a line fault or power loss for all supervised data cables.
- a. Line Fault Detection: Communication links of the IDS shall have an active mode for line fault detection. Fault isolation at the systems level shall have the same geographic resolutions as provided for intrusion detection. The line fault alarm shall be clearly distinguishable from other alarms.
 - b. Power Loss Detection: Provide the capability to detect when critical components experience temporary or permanent loss of power and annunciate to clearly identify the component experiencing power loss.

2.7 KEYPADS

A. Keypads shall meet or exceed the following technical characteristics:

Connections	4-wire flying lead for data and power
Operating Temperature	0°C to +50°C (+32°F to +122°F)
Display Window	8-point LED
Indicators: Illuminated keys	Armed Status-LED
	Point Status-LED
	Command Mode-LED
	Power-LED
Voltage	Nominal 12 VDC

2.8 INPUT MODULE

A. An input module shall be utilized to connect additional detection devices to the control panel. This module will meet or exceed the following technical characteristics:

Operating Voltage	8.5 to 14.5 VDC Nominal
Zone Inputs	Style A (Class B) Supervised
Operating Temperature	0 to 40 degrees C (32 to 140 degrees F)

2.9 OUTPUT MODULE

- A. An output module shall be utilized to interface the control panel with other security subsystems. The output module shall meet or exceed the following technical characteristics:

Operating Voltage	8.5 to 14.5 VDC Nominal
Output Relays	"Form C" Dry Relay Contracts
Relay Contact Rating	4A @ 24 VDC
	4A @ 24 VAC
	1A @ 70 VAC
Operating Temperature	0 to 40 degrees C F (32 to 140 degrees)

2.10 INTERIOR DETECTION DEVICES (SENSORS)

- A. The IDS shall consist of interior, exterior, and other detection devices that are capable of:
1. Locating intrusions at individually protected asset areas or at an individual portal;
 2. Locating intrusions within a specific area of coverage;
 3. Locating failures or tampering of individual sensors or components.
- B. Provide and adjust for devices so that coverage is maximized in the space or area it is installed in. For large rooms where multiple devices are required, ensure device coverage is overlapping.
- C. Detection sensitivity shall be set up to ensure maximum coverage of the secure area is obtained while at the same time limiting excessive false alarms due to the environment and impact of small animals. All detection devices shall be anti-masking with exception of video motion detection.
- D. Dual sensor technology shall be used when possible. Sensor technology shall not be of the same type that is easily defeated by a single method. This will reduce the amount of false alarms.
- E. Interior Environmental Conditions: Systems shall be able to operate in environmentally protected interior areas and shall meet operational performance requirements for the following ambient conditions:
1. If components are installed in unheated areas they shall be able to operate in temperatures as low as -17 C (0 F);
 2. Interior Sensor Environmental Characteristics:

Temperatures	0 to 50 C (32F to 120 F)
Pressure	Sea Level to 4573m (15,000 ft.) above sea level
Humidity	5% - 95%
Fungus	Components of non-fungus nutrient materials
Acoustical Noise	Suitable for high noise environments above 100db

F. Passive Infrared Motion Sensors (PIR)

1. These sensors shall detect an intruder presence by monitoring the level of infrared energy emitted by objects within a protected zone and meet ANSI PIR-01 Passive Infrared Motion Detector Standards Features for Enhancing False Alarm Immunity. An alarm shall be initiated when motion and temperature changes within set patterns are detected as follows.
2. The detector shall provide multiple detection zones distributed at a variety of angles and distance.
3. Sensors shall be passive in nature; no transmitted energy shall be required for detection.
4. Sensors shall be sensitive to infrared energy emitted at wavelengths corresponding to human body and other objects at ambient temperatures.
5. Sensors shall not alarm in response to general area thermal variations and shall be immune to radio frequency interference.
6. Sensors shall not be susceptible to changes in temperature due to an air conditioner being turned on or off.
7. Sensors shall be housed in a tamper-alarmed enclosure.
8. Sensor detectors shall include motion analyzer processing, adjustable lens, and walk test LED's visible from any angle.
9. Sensors shall provide some means of indicating an alarm condition during installation and calibration. A means of disabling the indication shall be provided within the sensor enclosure.
10. Sensor detectors shall include a motion monitoring verification circuit that will signal trouble or alarm if the detector fails to detect motion for an extended period.
11. PIR Technical Characteristics:

Power	Six (6) - 12 VDC 25 mA continuous current draw 38 mA peaks
Alarm Velocity	1500 mm (Five (5) ft.) at a velocity of 30 mm (0.1 ft.) per second, and one (1) step per second, assuming 150 mm (6 in.) per step. Also, faster than 30 mm (1 foot) per second, up to 3000 mm (10 feet) per second
Maximum detection range	10.6 m (35 ft.)
Frequency range- non activation or setup use	26 to 950 MHz using a 50 watt transmitter located 1 ft. from the unit or attached wiring
Infrared detection	1 1/2°C (3°F) different from the background temperature
Detection Pattern	180 degrees for volumetric units, non PIR 360
PIR 360°Detection Pattern	Programmable 60 detection zones including one directly below
Mounting	Ceiling and walls
Ceiling heights	2.4 m (Eight (8) ft.) - 5.4 m (18 ft)
Sensitivity adjustments	Three (3) levels

2.12 TAMPER ALARM SWITCHES

A. The following IDS sensors shall be used to monitor and detect potential tampering of sensors, control panels and enclosures.

1. Tamper Switches: All enclosures including cabinets, housings, boxes, raceways, and fittings with hinged doors or removable covers containing circuits and power supplies related to the IDS shall include corrosion-resistant tamper switches.
2. Tamper alarms shall be annunciated to be clearly distinguishable from IDS alarms.
3. Tamper switches will not be in a viewable from a direct line of sight perspective. The minimum amount of time the tamper switch becomes active and sends a signal after an enclosure is opened or panel removable is attempted, shall be one (1) second.

4. Tamper switches will initiate when enclosure doors or covers is removed as little as 6.35 mm (1/4 inch) from the closed position unless otherwise indicated. Tamper switches shall be:
 - a. Push/pull automatic reset type;
 - b. Inaccessible until switch is activated;
 - c. Spring-loaded and held in closed position by door or cover; and
 - d. Wired to break a circuit when door or cover is removed with each sensor annunciated individually at a central reporting processor.
5. Fail-Safe Mode: Shall provide the capability to detect and annunciate diminished functional capabilities and perform self-tests. Fail-safe alarms shall be annunciated to be clearly distinguishable from other types of alarms.

2.13 POWER SUPPLY

- A. A power supply shall only be utilized if the control panel is unable to support the load requirements of the IDS system.
- B. All power supplies shall be UL rated and able to adequately power two entry control devices on a continuous base without failure.
- C. Power supplies shall meet the following minimum technical characteristics:

INPUT POWER	110 VAC 60 HZ 2 amp
OUTPUT VOLTAGE	12 VDC Nominal (13.8 VDC) 24 VDC Nominal (27.6 VDC) Filtered and Regulated
BATTERY	Dependant on Output Voltage shall provide up to [insert number]Ah, rechargeable
OUTPUT CURRENT	4 amp max. @ 13.8 VDC 3 amp max. @ 27.6 VDC
BATTERY FUSE SIZE	3.5 A @ 250 VAC
CHARGING CIRCUIT	Built-in standard

2.14 AUDIBLE AND VISUAL ALARM DEVICES

- A. Bell: Central-station control unit 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from central-station control unit.
 1. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.

- B. Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: two minutes on and five minutes off.
1. Designed for use in industrial areas and in high noise, severe weather marine environments.
- C. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from central-station control unit.
1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
- D. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
1. Light Output: 115 cd, minimum.
 2. Flash Rate: 60 per minute.

2.15 SECURITY FASTENERS

- A. Security fasteners shall be operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
- B. Drive System Types: Pinned Torx or pinned hex (Allen).
- C. Socket Flat Countersunk Head Fasteners:
1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- D. Socket Button Head Fasteners:
1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- E. Socket Head Cap Fasteners:
1. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 2. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
- F. Protective Coatings for Heat-Treated Alloy Steel:
1. Zinc chromate, ASTM F 1135, Grade 3 or 4; for exterior applications and interior applications where indicated.
 2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. IDS installation shall be in accordance with Underwriters Laboratories (UL) 639 Standards for Intrusion Detection Units and UL 634 Standards for Connectors with Burglar Alarm Systems, and appropriate manufacture's installation manuals for each type of IDS.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including VA furnished equipment, and appurtenances in accordance with the manufacturer's instructions and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. The IDS will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or designed as a computer network.
- E. The IDS shall be able to be integrated with other security subsystems. Integration with these security subsystems shall be achieved by computer programming and the direct hardwiring of the systems. Determination for methodology shall be outlined when the system(s) is/are being designed and engineered. For installation purposes, the IDS shall utilize an output module for integration with other security subsystems. The Contractor will ensure all connections are per the OEM and that any and all software upgrades required to integrate the systems are installed prior to system start-up.
- F. For programming purposes, the Contractor shall refer to the manufacturer's requirements and Contracting Officer instructions for correct system operations. This includes ensuring computers being utilized for system integration meet or exceeds the minimum system requirements outlined in the IDS software packages.
- G. Lightning and power surges to the central alarm reporting and display unit shall be protected at both ends against excessive voltages. This requirement shall apply for circuits that are routed both in underground conduits and overhead runs.

- H. At a minimum, the Contractor shall install primary detection devices, such as three electrode gas-type surge arresters, and secondary protectors to reduce dangerous voltages to levels that will cause no damage. Fuses shall not be permitted as protection devices.
- I. The Contractor shall provide fail-safe gas tube type surge arresters on exposed IDS data circuits. In addition, transient protection shall protect against spikes up to 1000 volts peak voltage with a one-microsecond rise time and 100-microsecond decay time, without causing false alarms. The protective device shall be automatic and self-restoring. Also, circuits shall be designed or selected assuming a maximum of 25 ohms to ground.
- J. Product Delivery, Storage and Handling:
1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name, equipment model and serial identification numbers, and UL logo. The Contracting Officer may inventory the IDS equipment at the time of delivery and reject items that do not conform to this requirement.
 2. Storage and Handling: Store and protect equipment in a manner that will preclude damage as directed by the Contracting Officer.
- K. Cleaning and Adjustments:
1. Cleaning: Subsequent to installation, clean each system component of dust, dirt, grease, or oil incurred during installation in accordance to manufacture instructions.
 2. Prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or synchronization. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.
- L. Tamper Switches
1. Install tamper switches to initiate an alarm signal when a panel, box, or component housing door or cover is moved as little as 6.35 mm (1/4 inch) from the normally closed position unless otherwise specified.
 2. Locate tamper switches within enclosures, cabinets, housings, boxes, raceways, and fittings to prevent direct line of sight to any internal components and to prevent tampering with switch or circuitry.

3. Conceal tamper switch mounting hardware so that the location of the switch within the enclosure cannot be determined from the exterior.

M. Unique IDS Installation Components:

4. Passive Infrared Detectors: (PIR)
 - a. The protective beam shall be focused in a straight line.
 - b. Installed beam distance from transmitter to receiver shall not exceed 80% of the manufacturer's maximum recommended rating.
 - c. Mirrors may be used to extend the beam or to establish a network of beams. Each mirror used shall not lower the rated maximum system range by more than 50%.
 - d. Mirrors and photoelectric sources used in outdoor applications shall have self-heating capability to eliminate condensation and shall be housed in weatherproof enclosures.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceways according to Section 28 05 28.33 "CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (20 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- B. Wiring Method: Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (20 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to

system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer, unless otherwise indicated.
2. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable, unless otherwise indicated or if manufacturer recommends shielded cable, according to Division 28 Section "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY."
3. Computer and Data-Processing Cables: Install according to Division 28 Section "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY."
4. Television Signal Transmission Cables: Install according to Division 28 Section "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY."

- F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- G. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
- H. Identify components with engraved, laminated-plastic or metal nameplate for central-station control unit and each terminal cabinet, mounted with corrosion-resistant screws.

3.3 GROUNDING

- A. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide [ohm] ground. Measure, record, and report ground resistance.
- C. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 28

Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY
SYSTEMS."

3.4 STARTUP AND TESTING

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.6 TESTS AND TRAINING

- A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

-----END-----

SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and install a complete Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section.
- B. This Section includes video surveillance system consisting of cameras, data transmission wiring, and a control station with its associated equipment.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- D. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
- E. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- F. Section 26 05 41 - UNDERGROUND ELECTRICAL CONSTRUCTION. Requirements for underground installation of wiring.
- G. Section 26 56 00 - EXTERIOR LIGHTING. Requirements for perimeter lighting.
- H. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- J. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- K. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- L. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY. Requirements for commissioning, systems readiness checklists, and training.
- M. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEM. Requirements for physical access control system integration.

1.3 DEFINITIONS

- A. AGC: Automatic gain control.
- B. B/W: Black and white.
- C. CCD: Charge-coupled device.
- D. CIF: Common Intermediate Format CIF images are 352 pixels wide and 88/240 (PAL/NTSC) pixels tall (352 x 288/240).
- E. 4CIF: resolution is 704 pixels wide and 576/480 (PAL/NTSC) pixels tall (704 x 576/480).
- F. H.264 (also known as MPEG4 Part 10): a encoding format that compresses video much more effectively than older (MPEG4) standards.
- G. ips: Images per second.
- H. MPEG: Moving picture experts group.
- I. MPEG4: a video encoding and compression standard that uses inter-frame encoding to significantly reduce the size of the video stream being transmitted.
- J. NTSC: National Television System Committee.
- K. UPS: Uninterruptible power supply.
- L. PTZ: refers to a movable camera that has the ability to pan left and right, tilt up and down, and zoom or magnify a scene.

1.4 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the VASS System as shown. The Contractor shall also provide certification as required.
- B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.
- D. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- E. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

F. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Video Assessment and Surveillance System's (VASS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the VASS. The Contractor shall only utilize factory-trained technicians to install, terminate and service cameras, control, and recording equipment. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The COTR reserves the option of

- surveying the company's facility to verify the service inventory and presence of a local service organization.
2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
 3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.
- G. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 SUBMITTALS

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.6 COORDINATION

- A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

1.7 WARRANTY OF CONSTRUCTION

- A. Warrant VASS System work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.
- B. Demonstration and training shall be performed prior to system acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Video signal format shall comply with the NTSC standard composite video, interlaced. Composite video signal termination shall be 75 ohms.
- B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge

protection for external wiring of each conductor entry connection to components.

- C. Power Connections: Comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2, as recommended by manufacturer for type of line being protected.
- D. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 CAMERAS

- A. All Cameras will be EIA 330 and UL 1. Minimum Protection for Power Connections 120 V and more: Auxiliary panel suppressors shall comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2.
- B. Minimum Protection for Communication, Signal, Control, and Low-Voltage 983 compliant as well as:
 - 1. Will be charge coupled device (CCD cameras and shall conform to National Television System Committee (NTSC) formatting.
 - 2. Fixed cameras shall be color and the primary choice for monitoring following the activities described below. Pan/Tilt/Zoom (P/T/Z) cameras shall be color and are to be utilized to complement the fixed cameras.
 - 3. Shall be powered by either 12 volts direct current (VDC) or 24 volts alternate current (VAC). Power supplies shall be Class 2 and UL compliant and have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.
 - 4. Shall be powered over Ethernet. Network switches supporting PoE cameras shall have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.
 - 5. Shall be rated for continuous operation under the environmental conditions listed in Part 1, Project Conditions.
 - 6. Will be home run to a monitoring and recording device via a controlling device such as a matrix switcher or network server and

- monitored on a 24 hour basis at a designated Security Management System location.
7. Each function and activity shall be addressed within the system by a unique user defined name, with minimum of twenty (20) characters. The use of codes or mnemonics identifying the VASS action shall not be accepted.
 8. Shall come with built-in video motion detection that shall automatically monitor and process information from each camera. The camera motion detection shall detect motion within the camera's field of view and provide automatic visual, remote alarms as a result of detected motion.
 9. Shall be programmed to digitally flip from color to black and white at dusk and vice versa at low light conditions.
 10. Will be fitted with AI/DC lenses to ensure the image quality under different light conditions.
 11. P/T/Z cameras shall be utilized in a manner that they complement fixed cameras and shall not be used as a primary means of monitoring activity.
 12. Dummy or fake cameras will not be utilized at any time.
 13. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.

2.3 VIDEO CAMERAS

- A. The cameras shall be high-resolution color video cameras with wide dynamic range capturing capability.
- B. The camera shall meet or exceed the following specifications:
 1. The image capturing device shall be a [1/3]/[1/4]-inch image sensor designed for capturing wide dynamic images.
 - a. The image capturing device shall have a separate analog-to-digital converter for every pixel.
 - b. The image capturing device shall sample each pixel multiple times per second.
 - c. The dynamic range shall be 95 dB typical and 120 dB maximum.
 3. The camera shall optimize each pixel independently.
 4. The camera shall have onscreen display menus for programming of the camera's settings.
 5. The signal system shall be NTSC.

- C. The camera shall have composite video output.
- D. The camera shall come with a manual varifocal lens.
- E. The video output shall be composite: 1.0 volts peak-to-peak at 75-ohm load.
- H. Fixed Color Camera
 - 1. The camera shall be a high-resolution color video camera with wide dynamic range capturing capability.
 - 2. Comply with UL 639.
 - 3. Pickup Device: [1/3]/[1/4] CCD interline transfer.
 - 4. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.
 - 5. With AGC, manually selectable on or off.
 - 6. Manually selectable modes for backlight compensation or normal lighting.
 - 7. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - 8. White Balance: Auto-tracing white balance, with manually selectable fixed balance option.
 - 9. Fixed Color Cameras Technical Characteristics:

Pickup device	1/3" interline transfer CCD
Total pixels	NTSC: 811(H) x 508(V)
Effective pixels	NTSC: 768(H) x 494(V)
Resolution	500 TV lines
Sync. System	Internal Sync
Scanning system	NTSC: 525 Lines/60 Fields
S/N ratio	More than 48 dB
Electronic shutter	Auto 1/60 (1/50) ~1/100,000 sec.
Min. illumination	0.2 lux F2.0
Video output	Composite 1.0 Vp-p/75 ohm
White balance	Auto
Automatic gain control	ON
Frequency horizontal	NTSC: 15.734 KHz
Frequency vertical	NTSC: 59.94Hz
Lens type	Board lens/[DC]/[AI] varifocal lens
Focal length	[3-12mm]<insert values>

Power source	DC12V/500mA or AC24/500mA
Power consumption	< 3W (Max)

10. [Fixed color camera shall be enclosed in dome and have board mounted varifocal lens].
11. Camera accessories shall include:
 - a. Surface mount adapter
 - b. Wall mount adapter
 - c. Flush mount adapter
 - d. <list>

2.4 POWER SUPPLIES

- A. Power supplies shall be a low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by camera[, infrared illuminator,] and lens manufacturer.
- B. Technical specifications:
 1. Input: 115VAC, 50/60Hz, 2.7 amps
 2. Outputs:
 - a. Number of outputs, [16] <insert number of outputs>
 - b. [Fuse/PTC] <insert type> protected, power limited
 - c. Output voltage & power:
 - 1) 24VAC @ 12.5 amps (300VA) or 28VAC @ 10 amp (280VA) supply current
 3. Illuminated power disconnect circuit breaker with manual reset
 4. Surge suppression
 5. Camera synchronization
 6. [Wall/Rack] <insert mount type> mount.
 7. Enclosure: NEMA 250, Type [1] [3] [4X] <Insert enclosure type>.

2.5 RECORDING DEVICES

- A. All cameras on the VASS System shall be recorded in real time using a Digital Video Recorder (DVR), Network Video Recorder (NVR), or attached storage. The type of recording device utilized should be determined by the size and type of VASS System designed and installed, and to what extent the system is to be utilized.
- B. All recording devices shall be 47.5 cm (19 inch) rack-mountable.
- C. All DVR's and NVR's that are viewable over an Intranet or Internet will be routed through an encryptor.

D. Encryptors shall:

1. Comply with FIPS PUB 140-2.
2. Support TCP/IP.
3. Directly interfaces to low-cost commercial routers.
4. Provide packet-based crypto synchronization.
5. Encrypt source and destination IP addresses.
6. Support web browser based management requiring no additional software.
7. Have a high data sustained throughput – 1.544 Mbps (T1) full duplex data rate.
8. Provide for both bridging and routing network architecture support.
9. Support Electronic Key Management System (EKMS) compatible.
10. Have remote management ability.
11. Automatically reconfigure when secure network or wide area network changes.

E. Digital Video Recorder (DVR)

1. Shall record video to a hard drive-based digital storage medium in either NTSC or MPEG format.
2. Shall meet the following minimum requirements:
 - a. Record at minimum rate of 30 images per second (IPS).
 - b. Have a minimum of eight (8) to 16 looping inputs.
 - c. Have a minimum of eight (8) to 16 alarm inputs and two (2) relay outputs.
 - d. Shall provide instantaneous playback of all recorded images.
 - e. Be IP addressable, if part of a VASS network.
 - f. Have built-in digital motion detection with masking and sensitivity adjustments.
 - g. Provide easy playback and forward/reverse search capabilities.
 - h. Complete audit trail database, with minimum of a six-month history that tracks all events related to the alarm; specifically who, what, where and when.
 - i. DVR management capability providing automatic video routing to a back-up spare recorder in case of failure.
 - j. Accessible locally and remotely via the Internet, Intranet, or a personal digital assistant (PDA).
 - k. Records all alarm events in real time, ensuring 60 seconds before and after the event are included in the recording.

1. Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.
 - m. Allow for independently adjustable frame rate settings.
 - n. Be compatible with the matrix switcher utilized to operate the cameras. The DVR could be utilized as a matrix switcher only if it meets all of the requirements listed in the matrix switcher section.
3. Technical Characteristics:

Compression	MPEG-4
Internal Storage Capacities.	[160] GB, [320] GB, [500] GB, [1] TB, and 2 TB. Available USB hard drive up to 250 GB. Optional internal DVD available
Digital Recording	Up to [16] video and [8] audio channels, or [8] video and [4] audio channels.
Full real-time video recording	Up to 400 IPS@352 x 288: PAL Up to 200 IPS@352 x 288: PAL
Multiple simultaneous functions	Live viewing, Recording, playback, network transmission, back-up
Search functions	Date/time search, event search, bookmark search, smart (pixel) Search
PTZ Control	Third party PTZ control
User ID security	3 levels
Connectivity to external devices:	Eight [8] or sixteen [16] video input and looping output channels. VGA and dual monitor BNC outputs. Four [4] or eight [8] audio inputs and one [1] audio output. Ethernet 10/100BaseT network connection. Eight [8] to sixteen [16] alarm inputs and four [4] or eight [8] relay outputs. Biphase connection to control Bosch PTZ cameras. Third party PTZ control via RS-422/RS-485 connection. Front and back USB connectors to connect to a PC mouse, or archive video to a USB memory stick or similar device.

PC requirements	Windows 2000 or above; DirectX 8.1 or above. Intel Pentium III or above, AMD Athlon with 800 MHz or faster CPU. 512 MB or more RAM. 50 MB hard drive. AGP VGA with 64 MB video RAM or above. 10/100-BaseT network interface.
Electrical	Power Input: 100 to 240 VAC; 50/60 Hz Power consumption: [120W] Max. [1.2] A
Video	Video standard: PAL or NTSC selectable. Resolution: 704 x 576 PAL, 704 x 480 NTSC Compression: MPEG-4 Inputs: 8 or 16 composite video 0.5-2 Vpp, 75 Ohm automatic termination. Outputs 8 or 16 composite video 1 Vpp, 75 Ohm.
Audio	Inputs: 4 or 8 line in, 30 kOhm Output: 1 line, 100 kOhm
Monitors	VGA: analog RGB 800x600 MON A: CVBS 1 Vpp□0.1 V, 75 Ohm, BNC Monitor A multi-screen (VGA or CVBS) MON B: CVBS 1 Vpp□0.1 V, 75 Ohm, BNC Monitor B spot/alarm
Frame Rate and Resolution	[16]-channels PAL: Up to 400 IPS@352x288, up to 200 IPS@704x288, up to 100 IPS@704x576.
Alarm inputs	[8] [16] configurable NO/NC, max. input 5 VDC.
Alarm outputs	[4] or [8] relay outputs, configurable NO/NC, max. rated 1A, 125 VAC.
Connections	Ethernet: RJ45 modular jack 8 pins shielded, 10/100 Base-T. Biphase: Screw terminal connector (5 outputs). Maximum 5 controllable cameras per Biphase output. PTZ control interfaces: RS485/RS422. Serial interface: RS232 output signal, DB9 male connector Keyboard: RJ11 modular jack 6 pins
Network:	Transmission speed: up to 120

	IPS@352x240 Bandwidth control: Automatic Remote users: Maximum 5 simultaneous connected Control Center users.

Processor	Intel Pentium III 750 MHz
Memory	256 MB RAM
Operating System	Windows 98, NT, ME, 2000, and XP
Video Card	4 MB of RAM capable of 24-bit true color display
Free Hard Disk Space	160 MB for software installation
Network Card	10Base-T network for LAN operation
Archiving	80 GB, 160 GB, 320 GB and 640 GB Hard Drive; CD-RW
Video Input	1.0 Vpp (signal 714mV, sync 286mV) 75 ohms (BNC unbalanced)
Video Output Level	1.0 Vpp +/-10%, 75 ohms (BNC unbalanced)
Impedance	75 ohms/Hi- impedance x 16 switchable
Network Interface	Ethernet (RJ-45, 10/100M)
Network Protocol	TCP/IP, DHCP, HTTP, UDP
Network Capabilities	Live/Playback/P/T/Z control
Recording Rate	30 ips for 720 x 240 (NTSC)
Password Protection	Menu Setup, Remote Access
Recording Capacity	160 (1 or 2 fixed HDD) 1 CD-RW
Power Interrupt	Auto recovered to recording mode

F. Network Video Recorder (NVR)

1. Shall record video to a hard drive-based digital storage medium in MPEG, MPEG4 or H.264 format.
2. Shall meet the following minimum requirements:
 - a. Record at minimum rate of 30 IPS.
 - b. Have a minimum of eight (8) to 16 looping inputs.
 - c. Have a minimum of eight (8) to 16 alarm inputs and two (2) relay outputs.
 - d. Shall provide instantaneous playback of all recorded images.
 - e. Be IP addressable, if part of a VASS network.

- f. Have built-in digital motion detection with masking and sensitivity adjustments.
- g. Easy playback and forward/reverse search capabilities.
- h. Complete audit trail database, with minimum of a six-month history that tracks all events related to the alarm; specifically who, what, where and when.
- i. NVR management capability providing automatic video routing to a back-up spare recorder in case of failure.
- j. Accessible locally and remotely via the internet, intranet, or a personal digital assistant (PDA).
- k. Records all alarm events in real time, ensuring 60 seconds before and after the event are included in the recording.
- l. Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.
- m. Allow for independently adjustable frame rate settings.
- n. Be compatible with the matrix switcher utilized to operate the cameras.

3. Technical Characteristics:

Hardware/CPU	Pentium III Xeon or IV, 1.8 GHz
HDD Interface	IDE or better; optional: SCSI II, SCSI Ultra, or Fiber Channel
RAM	1024 MB
Operating System	Windows 2000/XP Professional/Server 2003 Standard
Graphic	Card VGA
Ethernet Card	100/1000 MB
Memory	20 MB
Software Setup	Centralized setup from each authorized PC; access via integrated web server
Storage Media	All storage media possible (e.g., HD, RAID), depending on operating system
Storage Mode	Linear mode, ring mode (capacity-based)
Recording Configuration	Camera name assignment, bandwidth limit, frame rate, video quality
Recording Content	Video and/or audio data
Search Parameters	Time, date, event
Playback	Playback via any IP network (LAN/WAN) simultaneous recording, playback, and backup

Network Interface	Ethernet (RJ-45, 10/100M)
Network Protocol	TCP/IP, DHCP, HTTP, UDP
Network Capabilities	Live/Playback/P/T/Z control
Recording Rate	30 ips for 720 x 240 (NTSC)
Password Protection	Menu Setup, Remote Access
Recording Capacity	160 (1 or 2 fixed HDD) 1 CD-RW
Power Interrupt	Auto recovered to recording mode

2.6 WIRES AND CABLES

- A. Shall meet or exceed the manufactures recommendation for power and signal.
- B. Will be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
- C. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
- D. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.
- E. Conduit fills shall not exceed 50 percent unless otherwise documented.
- F. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
- G. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area
- H. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.
- I. For all equipment that is carrying digital data between the Physical Access Control System and Database Management or at a remote monitoring station, shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

J. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within 1 m. (3 ft.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:

1. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and peak current of 60 amperes.
2. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.

K. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.

L. Coaxial Cables

1. All video signal cables for the VASS System, with exception to the PoE cameras, shall be a coaxial cable and have a characteristic impedance of 75 ohms plus or minus 3 ohms.
2. For runs up to 750 feet use of an RG-59/U is required. The RG-59/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 23 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
3. For runs between 750 feet and 1250 feet, RG-6/U is required. RG-6/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 18 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
4. For runs of 1250 to 2750 feet, RG-11/U is required. RG-11/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 14 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
5. All runs greater than 2750 feet will be substituted with a fiber optic cable. If using fiber optics as a signal carrier then the following equipment will be utilized:
 - a. Multimode fiber optic cable a minimum size of 62 microns

- b. Video transmitter, installed at the camera that utilizes 12 VDC or 24 VAC for power.
 - c. Video receiver, installed at the switcher.
6. RG-59/U Technical Characteristics

AWG	22
Stranding	7x29
Conductor Diameter	.031 in.
Conductor Material	BCC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.145 in.
Outer Shield Type	Braid/Braid
Outer Jacket Material	PVC
Overall Nominal Diameter	.242 in.
UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.094 µH/ft
Nom. Capacitance	Conductor to Shield 17.0 pF/ft
Nom. Velocity of Propagation	80 %
Nom. Delay	1.3 ns/ft
Nom. Conductor DC Resistance @ 20°C	12.2 Ohms/1000 ft
Nom. Outer Shield DC Resistance @ 20°C	2.4 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

7. RG-6/U Technical Characteristics:

AWG	18
Stranding	7x27
Conductor Diameter	.040 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.180 in.
Outer Shield Material	Trade Name Duofoil
Outer Shield Type	Tape/Braid
Outer Shield %Coverage	100 %

Outer Jacket Material	PVC
Overall Nominal Diameter	.274 in.
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.106 μ H/ft
Nom. Capacitance	Conductor to Shield 16.2 pF/ft
Nom. Velocity of Propagation	82 %
Nom. Delay	1.24 ns/ft
Nom. Conductor DC Resistance	6.4 Ohms/1000 ft
Nominal Outer Shield DC Resistance @ 20°C	2.8 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

8. RG-11/U Technical Characteristics:

AWG	15
Stranding	19x27
Conductor Diameter	.064 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.312 in.
Inner Shield Type	Braid
Inner Shield Material	BC - Bare Copper
Inner Shield %Coverage	95 %
Inner Jacket Material	PE - Polyethylene
Inner Jacket Diameter	.391 in.
Outer Shield Type	Braid
Outer Shield Material	BC - Bare Copper
Outer Shield %Coverage	95 %
Outer Jacket Material	Trade Name Belflex
Outer Jacket Material	PVC Blend
Overall Nominal Diameter	.520 in.
Operating Temperature Range	-35°C To +75°C
Non-UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.097 μ H/ft
Nom. Capacitance	Conductor to Shield 17.3

	pF/ft
Nom. Velocity of Propagation	78 %
Nom. Delay	1.30 ns/ft
Nom. Conductor DC Resistance	3.1 Ohms/1000 ft
Nom. Inner Shield DC Resistance	1.8 Ohms/1000 ft
Nom. Outer Shield DC Resistance	1.4 Ohms/1000 ft
Max. Operating Voltage Non-UL	300 V RMS

9. Signal Cables:

- a. Signal wiring for PoE cameras depends on the distance the camera is being installed from either a hub or the server.
- b. If the camera is up to 300 ft from a hub or the server, then use a shielded UTP category 5 (CAT-V) cable with standard RJ-45 connector at each end. The cable must comply with the Power over Ethernet, IEEE802.3af, Standard.
- c. If the camera is over 300 ft from a hub or server then utilize a multimode fiber optic cable with a minimum size of 62 microns.
- d. Provide a separate cable for power.
- e. CAT-5 Technical Characteristics:

Number of Pairs	4
Total Number of Conductors	8
AWG	24
Stranding	Solid
Conductor Material	BC - Bare Copper
Insulation Material	PO - Polyolefin
Overall Nominal Diameter	.230 in.
IEC Specification	11801 Category 5
TIA/EIA Specification	568-B.2 Category 5e
Max. Capacitance Unbalance	(pF/100 m) 150 pF/100 m
Nom. Velocity of Propagation	70 %
Max. Delay	(ns/100 m) 538 @ 100MHz
Max. Delay Skew	(ns/100m) 45 ns/100 m
Max. Conductor DC Resistance	9.38 Ohms/100
Max. DCR Unbalance@ 20°C	3 %
Max. Operating Voltage	UL 300 V RMS

10. Fiber Optic Cables Technical Characteristics:

Fiber Type	62.5 Micron
Number of Fibers	4
Core Diameter 6	2.5 +/- 2.5 microns
Core Non-Circularity	5% Maximum
Clad Diameter	125 +/- 2 microns
Clad Non-Circularity	1% Maximum
Core-clad Offset	1.5 Microns Maximum
Primary Coating Material	Acrylate
Primary Coating Diameter	245 +/- 10 microns
Secondary Coating Material	Engineering Thermoplastic
Secondary Coating Diameter	900 +/- 50 microns
Strength Member Material	Aramid Yarn
Outer Jacket Material	PVC
Outer Jacket Color	Orange
Overall Diameter	.200 in.
Numerical Aperture	.275
Maximum Gigabit Ethernet	300 meters
Maximum Gigabit Ethernet	550 meters

11. Power Cables

- a. Will be sized accordingly and shall comply with the NEC. High voltage power cables will be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables will be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.
- b. Will be utilized for all components of the VASS System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed will be connected to a dedicated circuit breaker at a power panel that is primarily for the security system.
- c. All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used as a means of surge protection.
- d. Shall be rated for either 110 or 220 VAC, 50 or 60 Hz, and shall comply with VA Master Spec 26 05 21 Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).

e. Low Voltage Power Cables

- 1) Shall be a minimum of 18 AWG, Stranded and have a polyvinylchloride outer jacket.
- 2) Cable size shall determined using a basic voltage over distance calculation and shall comply with the NEC's requirements for low voltage cables.

PART 3 - EXECUTION

3.1. GENERAL

- A. Installation: The Contractor shall install all system components including Owner furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.
- B. Identification and Labeling: The Contractor shall supply permanent identification labels for each cable at each end that will appear on the as-built drawings. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified by type or signal being carried and termination points. The labels shall be printed on letter size label sheets that are self laminated vinyl that can be printed from a computer data base or spread sheet. The labels shall be E-Z code WES12112 or equivalent.
1. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.
- C. Transient Voltage Surge Suppressors (TVSS): The Contractor shall mount TVSS within 3 m (118 in) of equipment to be protected inside terminal cabinets or suitable NEMA 1 enclosures. Terminate off-premise conductors on input side of device. Connect the output side of the device to the equipment to be protected. Connect ground lug to a low impedance earth ground (less than 10 ohms) via Number 12 AWG insulated, stranded copper conductor.
- D. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system during the Contractor's Field Testing. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 1,000,000

bits of data on each DTM circuit and measuring the bit error rate. The bit error rate shall not be greater than one (1) bit out of each 100,000 bits sent for each dial-up DTM circuit, and one (1) bit out of 1,000,000 bits sent for each leased or private DTM circuit. The Contractor shall submit a report containing results of the field test.

- E. Acceptance Test and Endurance Test: The wire line data transmission system shall be tested as a part of the completed IDS and EECS during the Acceptance test and Endurance Test as specified.
- F. Identification and Labeling: The Contractor shall supply identification tags or labels for each cable. Cable shall be labeled at both end points and at intermediate hand holes, manholes, and junction boxes. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified with type of signal being carried and termination points.

3.2 INSTALLATION

- A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. The VASS System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a complete network.
- E. For integration purposes, the VASS System shall be integrated where appropriate with the following associated security subsystems:
 - 1. PACS:

- a. Provide 24 hour coverage of all entry points to the perimeter and agency buildings, as well as all emergency exits utilizing a fixed color camera.
 - b. Record cameras on a 24 hours basis.
 - c. Be programmed go into an alarm state when an emergency exit is opened, and notify the Physical Access Control System and Database Management of an alarm event.
2. IDS:
 - a. Provide a recorded alarm event via a color camera that is connected to the IDS system by either direct hardwire or a security system computer network.
 - b. Record cameras on a 24 hours basis.
 - c. Be programmed to go into an alarm state when an IDS device is put into an alarm state, and notify the PACS.
 - d. For additional VASS System requirements as they relate to the IDS, refer to Section 28 16 00 "INTRUSION DETECTION".
3. Security Access Detection:
 - a. Provide full coverage of all vehicle and lobby entrance screening areas utilizing a fixed color camera.
 - b. Record cameras on a 24 hours basis.
4. EPPS:
 - a. Provide a recorded alarm event via a color camera that is connected to the EPPS system by either direct hardwire or a security system computer network.
 - b. Record cameras on a 24 hours basis.
 - c. Be programmed to go into an alarm state when an emergency call box or duress alarm/panic device is activated, and notify the Physical Access Control System and Database Management of an alarm event.
- F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.
- G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.
- H. A complete VASS System shall be comprised of, but not limited to, the following components:

1. Cameras
 2. Lenses
 3. Video Display Equipment
 4. Camera Housings and Mounts
 5. Controlling Equipment
 6. Recording Devices
 7. Wiring and Cables
- I. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.
- J. Existing Equipment
1. The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in the design package. Video equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.
 2. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the VASS System, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
 3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.

4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.
 5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.
- K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.
- L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.
- M. Interconnection of Console Video Equipment: The Contractor shall connect signal paths between video equipment as specified by the OEM. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.
- N. Cameras:
1. Install the cameras with the focal length lens as indicated for each zone.
 2. Connect power and signal lines to the camera.
 3. Aim camera to give field of view as needed to cover the alarm zone.

4. Aim fixed mounted cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun.
5. Focus the lens to give a sharp picture (to include checking for day and night focus and image quality) over the entire field of view
6. Synchronize all cameras so the picture does not roll on the monitor when cameras are selected.
7. PTZ cameras shall have all preset positions and privacy areas defined and programmed.

O. Monitors:

1. Install the monitors as shown and specified in design and construction documents.
2. Connect all signal inputs and outputs as shown and specified.
3. Terminate video input signals as required.
4. Connect the monitor to AC power.

P. Switcher:

1. Install the switcher as shown in the design and construction documents, and according to the OEM.
2. Connect all subassemblies as specified by the manufacturer and as shown.
3. Connect video signal inputs and outputs as shown and specified; terminate video inputs as required.
4. Connect alarm signal inputs and outputs as shown and specified; connect control signal inputs and outputs for ancillary equipment or secondary control/monitoring sites as specified by the manufacturer and as shown.
5. Connect the switcher CPU and switcher subassemblies to AC power.
6. Load all software as specified and required for an operational VASS System configured for the site and building requirements, including data bases, operational parameters, and system, command, and application programs.
7. Provide the original and 2 backup copies for all accepted software upon successful completion of the endurance test.
8. Program the video annotation for each camera.

Q. Video Encoder/Decoder

1. Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.

2. Connect analog camera inputs to video encoder.
3. Connect network camera to video decoder.
4. Connect video encoder to VASS network.
5. Connect video decoder to video matrix, DVR, monitor etc.
6. Connect unit to AC power (UPS).
7. Configure the video encoder/decoder per manufacturer's recommendation and project requirements.

R. Video Server:

1. Install the video server per design and construction documents, and as specified by the OEM.
2. Connect video server to AC power (UPS).
3. Connect to VASS network.
4. Install operating system and Video Management Software.
5. Provide Video Management Software programming per VA guidance and the requirements provided by the Owner. Programming shall include:
 - a. Camera names
 - b. Screen views
 - c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.
 - d. Video detection zones for each camera requiring video motion detection
 - e. Alarm interface
 - f. Alarm outputs
 - g. GUI maps, views, icons and actions
 - h. PTZ controls (presets, time schedules for privacy zones etc.)
 - i. Reports

S. Video Workstation:

1. Install the video workstation per design and construction documents, and as specified by the OEM.
2. Connect video workstation to AC power (UPS).
3. Connect to VASS network.
4. Install operating system and application software.
5. Provide application software programming per VA guidance and the requirements provided by the Owner. Programming shall include:
 - a. Screen views
 - b. Graphical User Interface (GUI) maps, views, icons and actions

c. Alarm outputs

d. Reports

T. Network Switch:

1. Install the network switch per design and construction documents, and as specified by the OEM.
2. Connect network switch to AC power (UPS).
3. Connect network cameras to network switch.
4. Configure the network switch per manufacturer's recommendation and project requirements.

U. Network Recording Equipment

1. Install the NVR or video storage unit as shown in the design and construction documents, and as specified by the OEM.
2. Connect recording device to AC power (UPS).
3. Connect recording device to network switch as shown and specified.
4. Configure network connections
5. Provide recording unit programming per VA guidance and the requirements provided by the Owner. Programming shall include:
 - a. Camera names
 - b. Screen views
 - c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.
 - d. Video detection zones for each camera requiring video motion detection
 - e. Alarm interface
 - f. Alarm outputs
 - g. GUI maps, views, icons and actions
 - h. PTZ controls (presets, time schedules for privacy zones etc.)
 - i. Reports

V. Video Recording Equipment:

1. Install the video recording equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video signal inputs and outputs as shown and specified.
3. Connect alarm signal inputs and outputs as shown and specified.
4. Connect video recording equipment to AC power.
5. Program the video recording equipment;
 - a. Recording schedules

b. Camera caption

W. Video Signal Equipment:

1. Install the video signal equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video or signal inputs and outputs as shown and specified.
3. Terminate video inputs as required.
4. Connect alarm signal inputs and outputs as required.
5. Connect control signal inputs and outputs as required
6. Connect electrically powered equipment to AC power.

X. Camera Housings, Mounts, and Poles:

1. Install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site.
2. Provide a foundation for each camera pole as specified and shown.
3. Provide a ground rod for each camera pole and connect the camera pole to the ground rod as specified in Division 26 of the VA Master Specification and the VA Electrical Manual 730.
4. Provide electrical and signal transmission cabling to the mount location via a hardened carrier system from the Physical Access Control System and Database Management to the device.
5. Connect signal lines and AC power to the housing interfaces.
6. Connect pole wiring harness to camera.

3.3 SYSTEM START-UP

A. The Contractor shall not apply power to the VASS System until the following items have been completed:

1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.
2. A visual inspection of the VASS System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
3. System wiring has been tested and verified as correctly connected as indicated.
4. All system grounding and transient protection systems have been verified as installed and connected as indicated.

5. Power supplies to be connected to the VASS System have been verified as the correct voltage, phasing, and frequency as indicated.
- B. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum of 7 days prior notice.
- C. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

3.4 SUPPLEMENTAL CONTRACTOR QUALITY CONTROL

- A. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed VASS System; and are approved by the Contracting Officer.
- B. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.
- C. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.
- D. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

3.5 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00 - "COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS" and related sections for contractor responsibilities for system commissioning.

3.6 DEMONSTRATION AND TRAINING

- A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, "GENERAL REQUIREMENTS".

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- B. Provide services of manufacturer's technical representative for [four]
<insert hours> hours to instruct VA personnel in operation and
maintenance of units.
- C. Submit training plans and instructor qualifications in accordance with
the requirements of Section 28 08 00 - "COMMISSIONING OF ELECTRONIC
SAFETY AND SECURITY SYSTEMS".

-----END-----

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc.
- B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL, NFPA 10, NFPA 20, NFPA 25, NFPA 70, NFPA 72, NFPA 101 and ANSI A117.1 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the Resident Engineer, COTR or his authorized representative. Installers shall have a minimum of 2 years' experience installing fire alarm systems.
- C. Fire alarm signals:
 - 1. Trinka Davis Facility shall have a new single story healthcare occupancy shall have an automatic digitized voice fire alarm signal with emergency manual voice override to notify occupants to evacuate. The digitized voice message shall identify the area of the building (smoke zone) from which the alarm was initiated.
 - 2. The new Trinka Davis single story Building shall have a general evacuation fire alarm signal in accordance with ASA S3.41 to notify all occupants in the respective building to evacuate.
- D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly

transmitted to the main fire alarm system control units located at the existing Trinka Davis Facility adjoining to this building addition.

- K. A dedicated TCP/IP fiber optic network shall be provided to connect the new building's addition fire alarm control panel to the existing Trinka Davis Facility Main Fire Alarm Control Panel.
- L. All equipment shall be new and the current products of a single manufacturer, actively engaged in the manufacturing and sale of digital fire detection devices for over ten years.
- M. Also included are system wiring, fiber optic cable, raceways, pull boxes, terminal cabinets, mounting boxes, and any accessories and miscellaneous items required for a code compliant system.
- N. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, is compatible with existing systems, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.
- N. Contractor shall refer to Drawing FA-003 Input/Output Matrix for signals that are to be sent from the local Fire Alarm Control Panel to be located within the new building construction and in turn, alarm signal shall be interfaced with the main fire alarm control panel within the Trinka Davis Village Main Fire Alarm Control Panel. This contractor shall have pre-wired all monitoring points and clearly labeled on a point-by-point basis in the new local fire alarm control panel to the existing Main Fire Alarm Control located in the existing Trinka Davis Village The existing fire alarm control panel in the Trinka Davis Village is manufactured by Simplex.

1.2 SCOPE

- A. A fully addressable fire alarm system as an extension of an existing addressable fire alarm system designed, and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.
- B. Basic Performance:
 - 1. Alarm and trouble signals from this building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.

2. Response time between alarm initiation (contact closure) and recording at this fire alarm control unit and the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
3. The signaling line circuits (SLC) between building fire alarm control units within the same building shall be wired Class B in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
4. Initiating device circuits (IDC) shall be wired Class B in accordance with NFPA 72.
5. Signaling line circuits (SLC) within buildings shall be wired Class B in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
6. Notification appliance circuits (NAC) shall be wired Style Class B in accordance with NFPA 72.
7. Communication cabling/wiring between the existing Main fire alarm control panel located in the existing Trink Davis Village to the new single story building addition shall be Class X Circuits and provided with isolation modules and surge suppression devices specified in Specification 280513, "Conductors and Cables for Electronic Safety and Security," Section 2.17 shall be adhered by this Contractor.
8. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
9. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building.
10. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
11. NAC speaker circuits and control equipment shall be arranged such that the loss of anyone (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
12. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
13. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide

- built-in speaker circuits, field configurable as four Class B, or two Class X circuits.
14. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
- a. The digital amplifier shall automatically broadcast the stored audio message.
 - b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
 - c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
15. All Tamper & Water Flow Switches
17. Exterior Fire Suppression Interfaces:
- a. Tamper Switches shall be provided on the OS&Y Valves on the Reduced Pressure Principle Assembly.
 - b. Post Indicator Valve, Tamper Switch
18. The fire alarm system shall interface with the fire suppression system within the new single-story addition.

1.3 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Requirements for procedures for submittals.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.
- C. Section 08 71 00 - DOOR HARDWARE. For combination Closer-Holders. D. Section 21 13 13 - WET-PIPE SPRINKLER SYSTEMS. Requirements for sprinkler systems.
- E. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

- F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- J. Section 28 08 00, COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.
- K. SECTION 33 10 00, WATER UTILITIES
- L. Section 31 20 00, EARTH MOVING: Excavation and Backfill.

1.4 SUBMITTALS

- A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Drawings:
 - 1. Prepare drawings using AutoCAD Release 2020 software and include all contractor's information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (COTR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
 - 2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions. Drawings shall provide wire specifications, and wire identification for all conductors depicted on the riser diagram. All

- circuits shall have identifiers that shall correspond with those required on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
3. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type of device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.
 4. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures, and equipment configuration.
 5. Shop Drawing shall include a bill of materials detailing each piece of equipment, conduit, wire, circuit type, electrical fittings, etc., that is required for fabrication of the additions to the current fire alarm system at the Trinka Davis Veterans Village to/from the Local Fire Alarm Control Panel in new Building Construction to the Main Fire Alarm Control Panel located in the existing adjoining building on the Trinka Davis Veterans Village Facility. The bill of materials shall include but not limited to manufacturer, size, model number, description, quantity, etc. The bill of materials shall include sufficient detail that when a part or piece of equipment is required to be replaced, the site will be easily able to order replacement parts and either have the installation completed by VA Site Representative or a Third-Party Contractor.
 6. Batteries: Size calculations.
 7. Voltage Drop: Provide voltage drop calculations for all power consuming circuits to validate that the system is designed within NFPA 72 tolerable limits. Notification Appliance Circuits voltage

- drop calculations shall have a maximum voltage drop of 15% and a preferred voltage drop of 10% meeting NFPA 72, section 10.3.5.
8. Audio (Speaker) Notification Appliance Circuits
 - a. The system shall be designed for interior building audibility level of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be designed to maintain Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in all areas designated on the drawings to have intelligible audio.
 - b. Provide dB loss calculations for all audio (speaker) notification appliance circuits. Circuits shall be designed for no more than 0.5 db., loss based on lump-sum load method.
 - c. All areas required to meet intelligibility requirements shall be modeled in a recognized computer modeling program. All modeling output data shall be part of the submittal.
 9. Fiber Optic Circuits:
 - a. Provide optical fiber loss (budget) calculations per segment of optical fiber. Fiber loss per segment shall not exceed 80% of equipment manufacturer's permitted loss.
 10. Furnish/Provide input/output matrix.
 11. Include statement from manufacturer that all equipment and components added because of this scope of work has been tested as a system and meet all requirements in this Specification and in NFPA 72.
 12. Control panel drawing(s) shall show internal component placement and all internal and field terminations. Provide details indicating where conduit connections shall be made to avoid conflicts with internally mounted batteries and existing installed components.
 13. Provide typical device wiring diagrams that show all system components, and the respective field wiring. Wire type, gauge, and jacket shall be indicated. When an addressable module is used in multiple configurations for monitoring or controlling equipment, provide a drawing for each application. End-of-line resistors (and values) shall be shown.
 14. Include performance parameters and installation details for each detector.
 15. A listing of the manufacturer's representative responsible for installation, coordination, and service.

16. Two weeks prior to final inspection, the Contractor shall deliver to the COTR 3 sets of as-built drawings and one set of the as-built drawing computer files using AutoCAD 2020 or later). As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
 - a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion, and maintenance.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
 - c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
 - d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
 - e. Complete listing of all digitized voice messages.
 - f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
 - g. Include information indicating who will provide emergency service and perform post contract maintenance.
 - h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
 - i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment

and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.

- j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
 - k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.
2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the COTR.
- a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
 - b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
 - c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.
 - d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.
 - e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

D. Certifications:

- 1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.
- 2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.
- 3. Together with the shop drawing submittal, submit a certification

from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer.

1.7 QUALITY ASSURANCE

- A. The work covered by this specification is to be coordinated with related work as specified elsewhere in this specification.
- B. National Fire Protection Association NFPA 10, Portable Fire Extinguishers
- C. The system shall be tested in accordance with the latest edition of the following:
 - 1. NFPA 70, National Electric Code
 - 2. NFPA 72 National Fire Alarm and Signaling Code
- E. Installer Qualifications: The installer shall be certified on the equipment being installed on the project within the past 24 months and a copy of this certification shall be included with the shop drawings. Technicians shall be available for a four-hour maximum response time on a service call. Supervisor of the installation, including field wiring, must be NICET Level III or Level IV Certified in Fire Alarm Systems.
- F. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- G. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- H. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer. The manufacturer of the fire alarm equipment is an "Owner Approved Item."
- I. Comply with NFPA 72.
- J. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- K. Each and all items of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and

shall bear the "U.L." label. Partial listings, or multiple listings for various major sections of the control, shall not be acceptable.

- L. Signals from a fire extinguisher electronic monitoring devices or fire extinguisher monitoring system shall transmit supervisory signals to a fire alarm system in compliance with NFPA 72.
- M. The connection to the electronic monitoring device relative to the fire extinguisher monitoring system shall be continuously supervised for integrity.
- N. The power source for the fire extinguisher electronic monitoring system/devices shall be supervised for continuity of power.

1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.

- B. National Fire Protection Association (NFPA):

- NFPA 13 Standard for the Installation of Sprinkler Systems, 2022 edition
- NFPA 70.....National Electrical Code (NEC), 2023 edition
- NFPA 72.....National Fire Alarm Code, 2022 edition
- NFPA 90A.....Standard for the Installation of Air Conditioning and Ventilating Systems, 2024 edition
- NFPA 101.....Life Safety Code, 2024 edition

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

Fire Protection Equipment Directory

UL 38	Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems, 2018 edition.
UL 268	Smoke Detectors for Fire Protective Signaling Systems, 2021 edition.
UL 346	Waterflow Indicators for Fire Protective Signaling Systems, 2019 edition.
UL 464	Audible Signaling Appliances, 2017 edition.
UL 521	Heat Detectors for Fire Protective Signaling Systems, 2023 edition.
UL 864	Standard for Control Units for Fire Protective

- UL-1480 Signaling Systems, 2016 edition.
 - UL 1481 Speakers for Fire Alarm, Emergency, and Commercial and Professional Use, 2017 edition
 - UL 1711 Power Supplies for Fire Protective Signaling Systems, 2006 edition.
 - UL 1635 Amplifiers for Fire Protective Signaling Systems, 2006 edition.
 - UL-1638 Digital Alarm Communicator System Units, 2018 edition
 - UL-1971 Signaling Appliances - Private Mode Emergency and General Utility Signaling, 2016 edition.
 - UL-2017 Standard for Signaling Devices for the Hearing Impaired, 2018 edition.
 - UL 2572 Standard for General-Purpose Signaling Devices and Systems, 2017 edition.
 - Communication and Control Units for Mass Notification Systems, 2016 edition
- D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011
- E. American National Standards Institute (ANSI):
- S3.41.....Audible Emergency Evacuation Signal, 2015
 - A117.1.....Standard for Accessible and Usable Buildings and Facilities, 2017 edition
- F. International Code Council, International Building Code (IBC), 2021 edition

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

- A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

- A. Conduit shall be in accordance with Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY and as follows:

1. All new conduits shall be installed in accordance with NFPA 70.
2. Conduit fill shall not exceed 40 percent of interior cross-sectional area.
3. All new conduits shall be 3/4-inch (19 mm) minimum.

B. Wire:

1. Wiring shall be in accordance with NEC article 760, Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.
3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.
4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.
5. Refer to Specification 28 05 00, "Common Work for Electronic Safety and Security" and Specification "28 05 13, "Conductors and Cables for Electronic Safety and Security" for Surge Suppression Requirements on specific equipment and systems.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. Covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type

terminal strips and shall be located at the base of each riser.

Terminal strips shall be labeled as specified or as approved by the
COTR.

2.3 EXISTING MASS NOTIFICATION FIRE ALARM SYSTEM

- A. New equipment shall be compatibility with Existing Equipment located in existing Trinka Davis Village Facility.

2.4 FIRE ALARM CONTROL UNIT

A. General:

1. General Description: Owner approved manufacturer/vendor for the fire alarm control unit.
2. Trinka Davis Fire Alarm Control Unit (FACU) Panel shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke detectors, addressable modules, horn/strobes, strobes, annunciators and other system-controlled devices.
3. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the Trinka Davis Fire Alarm Control Unit Panel shall perform the following functions:
 - a. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 - b. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
 - c. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
4. The Trinka Davis building addition shall be provided with a fire alarm control unit and shall operate as a supervised zoned fire alarm system.
5. Each power source shall be supervised from the other source for loss of power.
6. All circuits shall be monitored for integrity.

7. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
8. Transmit digital alarm information to the main fire alarm control unit.
- B. Trink Davis Building Expansion Fire Alarm Control Unit (FACU) Panel shall be able to provide the following software and hardware features:
 1. Positive Alarm Sequence: A Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
 2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
 3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
 4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
 5. The system shall support a detector response time to meet NFPA 72 annunciation requirements.
 6. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
 7. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
 8. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and down-load of programmed database and

- panel executive system program. A single change to one CPU database shall not require a data-base download to other CPUs.
9. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000-event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000-event history file.
 10. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
 11. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions where Owner shall approve this option prior to commissioning.
 12. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
 13. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
 14. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
 15. Read status preview - Enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.

16. Remote Graphic Annunciator Panel: Shall provide an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
17. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

C. Enclosure:

1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

D. Operator terminal at main control unit:

1. Operator terminal shall consist of the central processing unit, display screen, keyboard and printer.
2. Display screen shall have a minimum 15-inch (380 mm) diagonal non-glare screen capable of displaying 24 lines of 80 characters each.
3. Keyboard shall consist of 60 alpha numeric and 12 user/functional control keys.
4. Printer shall be the automatic type, printing the date, time and location for all alarm, supervisory, and trouble conditions.

E. Power Supply:

1. The control unit shall derive its normal power from a 120-volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24-volt DC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.
2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.
3. Power supply for smoke detectors shall be taken from the fire alarm

control unit.

4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
 5. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.
- F. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.
- G. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.
- H. Trouble signals:
1. Arrange the trouble signals for automatic reset (non-latching).
 2. System trouble switch off and on lamps shall be visible through the control unit door.
- I. Function Switches: Provide the following switches in addition to any other switches required for the system:
1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
 2. Alarm Off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
 3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
 4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.

5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
 6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
 7. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
 8. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.
- J. Remote Transmissions:
1. Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the main fire alarm control unit.
 2. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.
- K. Remote Control Capability: The building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledges, reset, silence or disabling functions can be operated by the main fire alarm control unit
- L. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.

2.5 STANDBY POWER SUPPLY

- A. Batteries:
1. Battery shall be of the sealed, maintenance free type, 24-volt nominal.
 2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure.
 3. Battery racks shall be steel with an alkali-resistant finish. Batteries shall be secured in seismic areas 2B, 3, or 4 as defined by the Uniform Building Code.

B. Battery Charger:

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt, 60 hertz emergency power source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.
5. A trouble condition shall actuate the fire alarm trouble signal.
6. Charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

2.6 ANNUNCIATION

A. Annunciator, Alphanumeric Type (System):

1. Shall be a supervised, LCD display containing a minimum of 2 lines of 40 characters for alarm annunciation in clear English text.
2. Message shall identify building number, floor, zone, etc., on the first line and device description and status (pull station, smoke detector, waterflow alarm or trouble condition) on the second line.
3. The initial alarm received shall be indicated as such.
4. A selector switch shall be provided for viewing subsequent alarm messages.
5. The display shall be UL listed for fire alarm application.
6. Annunciators shall display information for the buildings connected to the system. Local building annunciators, for general evacuation system buildings, shall be permitted when shown on the drawings and approved by the VA COTR.

2.7 VOICE COMMUNICATION SYSTEM (VCS)

A. General:

1. An emergency voice communication system shall be installed throughout new Trink Davis Village single story Healthcare Building.
2. Upon receipt of an alarm signal from the building fire alarm system, the VCS shall automatically transmit a pre-recorded fire alarm message throughout the building.
3. A digitized voice module shall be used to store each prerecorded

message.

4. The VCS shall be arranged as a dual channel system capable of transmitting 2 different messages simultaneously single channel system.
5. The VCS shall supervise all speaker circuits, control equipment, remote audio control equipment, and amplifiers.
6. Notification of staff for response shall be by digital voice (speaker) systems. For new systems, do not use coded or taped voice systems. Where speakers are installed as the notification appliance, the fire alarm system shall be designed such that it is possible to manually broadcast an emergency voice message simultaneously to all buildings provided with speakers. Selectable switches shall also be provided at the fire alarm voice control panel so that a manual voice message can be communicated to each connected building individually. As a minimum, provide one switch per building.

B. Speaker Circuit Control Unit:

1. The speaker circuit control unit shall include switches to manually activate or deactivate speaker circuits grouped by floor in the system.
2. Speaker circuit control switches shall provide on, off, and automatic positions and indications.
3. The speaker circuit control unit shall include visual indication of active or trouble status for each group of speaker circuits in the system.
4. A trouble indication shall be provided if a speaker circuit group is disabled.
5. A lamp test switch shall be provided to test all indicator lamps.
6. A single "all call" switch shall be provided to activate all speaker circuit groups simultaneously.
7. A push-to-talk microphone shall be provided for manual voice messages.
8. Remote microphones shall be provided in the identify location of 24-hour manned location within the Trink Davis Village Existing Building such as security office and/or telephone operators for manual "all call" messages to each individual building and throughout Trink Davis Village Facility to receive voice messages at one time.

9. A voice message disconnect switch shall be provided to disconnect automatic digitized voice messages from the system. The system shall be arranged to allow manual voice messages and indicate a system trouble condition when activated.

C. Speaker Circuit Arrangement:

1. Speaker circuits shall be arranged such that there is one speaker circuit per smoke zone.
2. Audio amplifiers and control equipment shall be electrically supervised for normal and abnormal conditions.
3. Speaker circuits shall be either 25 VRMS or 70.7 VRMS with a minimum of 50 percent spare power available.
4. Speaker circuits and control equipment shall be arranged such that loss of any one speaker circuit will not cause the loss of any other speaker circuit in the system.

D. Digitized Voice Module (DVM):

1. The Digitized Voice Module shall provide prerecorded digitized evacuation and instructional messages. The messages shall be professionally recorded and approved by the COTR prior to programming.
2. The DVM shall be configured to automatically output to the desired circuits following a 10-second slow whoop alert tone.
3. Prerecorded magnetic taped messages and tape players are not permitted.
4. The digitized message capacity shall be no less than 15 second in length.
5. The digitized message shall be transmitted 3 times.
6. The DVM shall be supervised for operational status.
7. Failure of the DVM shall result in the transmission of a constant alarm tone.
8. The DVM memory shall have a minimum 50 percent spare capacity after those messages identified in this section are recorded. Multiple DVM's may be used to obtain the required capacity.

E. Audio Amplifiers:

1. Audio Amplifiers shall provide a minimum of 50 Watts at either 25 or 70.7 VRMS output voltage levels.
2. Amplifiers shall be continuously supervised for operational status.
3. Amplifiers shall be configured for either single or dual channel application.

4. Each audio output circuit connection shall be configurable for Style X.

5. A minimum of 50 percent spare output capacity shall be available for each amplifier.

F. Tone Generator(s):

1. Tone Generator(s) shall be capable of providing a distinctive 3-pulse temporal pattern fire alarm signal as well as a slow whoop.

2. Tone Generator(s) shall be continuously supervised for operational status.

2.8 ALARM NOTIFICATION APPLIANCES

A. Speakers:

1. Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the 1/2 watt tap. Speakers shall provide a minimum sound output of 80 dBA at 10 feet (3,000 mm) with the 1/2 watt tap.

2. Frequency response shall be a minimum of 400 HZ to 4,000 HZ.

3. Four inches (100 mm) or 8 inches (200 mm) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

B. Strobes:

1. Xenon flash tube type minimum 15 candela in toilet rooms and all other areas the candela rate shall meet NFPA 72 with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).

2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.

3. Each strobe circuit shall have a minimum of 20 percent spare capacity.

4. Strobes may be combined with the audible notification appliances specified herein.

2.9 ALARM INITIATING DEVICES

A. Manual Fire Alarm Stations:

1. Shall be non-break glass, address reporting type.

2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.

3. Stations shall be of single action pull down type with suitable

operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."

4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.
6. The manual fire alarm boxes shall be addressable and send data to Trinka Davis Main Fire Alarm Control Panel representing the state of the manual switch and the addressable communication module status.

B. Smoke Detectors:

1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

D. Heat Detectors:

1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.

2. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).

3. Intermediate temperature rated (200 degrees F (93 degrees C)) heat detectors shall be utilized.

E. Multicriteria Multi-Sensor Fire Detectors:

1. Fire-Sensing detectors using multiple means of detection.

2. Sensors (Multi-sensor Type): Detector must be comprised of three sensing elements including smoke sensor, infrared sensor and heat sensor.

3. Each sensor must be separately listed in accordance with the requirements for its detector type.

F. Water Flow and Pressure Switches:

1. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.

2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type. Refer to Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS, Section 21 13 16, DRY-PIPE SPRINKLER SYSTEMS and Contract Drawings for new switches added. Connect all switches shown on the approved shop drawings.

3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

G. Extinguishing System Connections:

1. Kitchen Range Hood and Duct Suppression Systems:

a. Each suppression system shall be equipped with a micro-switch connected to the building fire alarm control unit. Discharge of a suppression system shall automatically send an alarm signal to the building fire detection and alarm system for annunciation.

b. Operation of this suppression system shall also automatically shut off all sources of fuel and heat to all equipment requiring protection under the same hood.

2.10 SUPERVISORY DEVICES

A. Duct Smoke Detectors:

1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have

perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.

2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler Supervisory Switches:

1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of an address reporting interface device. See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS, Section 21 13 16, WET-PIPE SPRINKLER SYSTEMS and Contract Drawings for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.

2.11 FIRE ALARM REMOTE ANNUNCIATOR

- A. Fire Alarm Annunciator shall meet NFPA 72 requirements.
- B. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit,

including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush or Surface cabinet, NEMA 250, Type 1; e.g., refer to contract drawing for mounting orientation.

C. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESS REPORTING INTERFACE DEVICE

A. Shall have unique addresses that reports directly to the building fire alarm panel.

B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.

C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.

D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.

E. Local functions and display at the digital alarm communicator transmitter shall include the following:

2. Programming device.

3. LED display.

4. Manual test report function and manual transmission clear indication.

F. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.

2. Address of the supervisory signal.

3. Address of the trouble-initiating device.

4. Loss of ac supply.

5. Loss of power.

6. Low battery.

7. Abnormal test signal.

8. Communication bus failure.

G. Secondary Power: Integral rechargeable battery and automatic charger.

H. Self-Test: Conducted automatically every 24 hours.

2.13 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm systems according to the fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written

requirements and requirements in NFPA 72 and NFPA 70.

2.14 SMOKE BARRIER DOOR CONTROL

A. Electromagnetic door holders:

1. New door holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.

2. Operation shall be by 24-volt dc supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.

B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.

C. Door holder control circuits shall be electrically supervised.

D. Smoke detectors shall not be incorporated as an integral part of door holders.

2.15 UTILITY LOCKS AND KEYS:

A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.

B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.

C. All keys shall be delivered to the COTR.

2.16 SPARE AND REPLACEMENT PARTS

A. Provide spare and replacement parts as follows:

1. Manual pull stations - 5
2. Heat detectors - 2 of each type
3. Fire alarm strobes - 2
4. Fire alarm bells - 2
5. Fire alarm speakers - 2
6. Smoke detectors - 2
7. Multi-Criteria Detector - 2 of each type
8. Duct smoke detectors with all appurtenances - 1
9. Sprinkler system water flow switch - 1 of each size
10. Sprinkler system water pressure switch - 1 of each type
11. Sprinkler valve tamper switch - 1 of each type
12. Control equipment utility locksets - 5
13. Control equipment keys - 25
14. 2.5 oz containers aerosol smoke - 12
15. Fire alarm SLC cable (same as installed) - 500 feet (152 m)

- B. Spare and replacement parts shall be in original packaging and submitted to the COTR.
- C. Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COTR.
- D. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

2.17 INSTRUCTION CHART:

- A. Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the COTR before being posted.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 28 05 13 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 26 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY, and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.
- B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
- C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.

- D. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the COTR.
- E. Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.
- F. Strobes shall be flush wall mounted with the bottom of the unit located 80 inches (2,000 mm) above the floor or 6 inches (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum 36 inches (900 mm) clearance from side obstructions.
- G. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from the finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.
- H. Where possible, locate water flow and pressure switches a minimum of 12 inches (300 mm) from a fitting that changes the direction of the flow and a minimum of 36 inches (900 mm) from a valve.
- I. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.
- J. Connect flow and tamper switches installed under Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.
- K. Connecting to existing Main Fire Alarm Control Panel located in the Trink Davis Village Facility: Verify that existing mass notification / fire-alarm system is operational before making changes or connections. If any deficiencies are found within the existing fire alarm system equipment the contractor shall submit a type written report describing the deficiency and the corrective work and associated timeframe required to make the correction.
 - 1. Connect/interface new equipment from new single story Healthcare Fire Alarm Control Panel to the Main Fire Alarm Control Panel located in the existing Trink Davis Village.
 - 2. Connect new equipment to existing monitoring equipment located at the Trink Davis Village Main Fire Alarm Control Panel supervising station.

3. Expand, modify, and supplement existing Main Fire Alarm Control Panel located within the Trinka Davis Village fire alarm control, and monitoring equipment as necessary to extend existing control and monitoring functions from new single story Healthcare Building located on the Trinka Davis Village Facility new monitoring and alarm points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

3.2 DEVICE PLACEMENT

- A. Fire alarm system devices shall be installed in a manner that provides accessibility for periodic maintenance or replacement of the entire device.
- B. Fire alarm system devices shall not be installed in inaccessible locations.
- C. Access to fire alarm system devices shall not be obstructed by conduit, plumbing, ductwork etc.

3.3 KITCHEN SMOKE ALARM REQUIREMENTS

- A. The contractor shall provide a local alarm for a cooking related non-hazardous smoke condition to meet the criteria for installation near the kitchen area meeting NFPA 101, Paragraphs 18.3.2.5.3(11), 18.3.2.5.3(12) and 18.3.2.5.3(13) as outlined below:
 1. Provide not less than two ac-powered photoelectric smoke detectors with battery backup and equipped with a silence feature not closer than 20 feet and not further than 25 feet from the cooktop or range.
 2. The smoke detectors shall provide the following criteria must be met [reference NFPA 101, Paragraph 18.3.2.5.3(13)]:
 - a. The detector is located not closer than 20 feet and not further than 25 feet from the cooktop or range.
 - b. The detector is permitted to initiate a local audible alarm signal only.
 - c. The detector is not required to initiate a building wide occupant notification signal.
 - d. The detector is not required to notify emergency forces.
 - e. The local audible signal initiated by the detector is permitted to be silenced and reset by a button on the detector or by a contractor installed switch installed within 10 feet of the system smoke detector.

3.4 TYPICAL OPERATION

- A. Activation of any manual pull station, water flow or pressure switch, heat detector, kitchen hood suppression system heat detector or smoke detector shall cause the following operations to occur:
1. Operate the emergency voice communication system in the new single story Healthcare Building. For sprinkler protected buildings, flash strobes continuously only in the zone of alarm.
 2. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in new Electrical Room within new single story healthcare building.
 3. Release only the magnetic door holders on the floor from which alarm was initiated after the alert signal.
 4. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
 5. Unlock the electrically locked exit doors within the zone of alarm.
- B. Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders on that floor in that smoke zone.
- C. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.
- D. Operation of any sprinkler or valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.
- E. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

3.5 TESTS

- A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all the adjustments and tests for the system. Make all adjustments and tests in the presence of the COTR.
- B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COTR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract

requirements. After the system has passed the initial test and been approved by the COTR, the contractor may request a final inspection.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
4. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
5. Open and short notification appliance circuits and verify that trouble signal actuates.
6. Open each alarm initiating and notification circuit to see if the trouble signal actuates.
7. Open and short signaling line circuits and verify that the trouble signal actuates.
8. Ground each alarm initiation and notification circuit and verify response of trouble signals.
9. Check presence and audibility of tone at all alarm notification devices.
10. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying voice messages.
11. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
12. Close each sprinkler system, follow valve, and verify proper supervisory alarm at Building 10 Fire Alarm Control Panel.
13. Verify activation of all waterflow switches.
14. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
15. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at new single story healthcare

- building and at the Trink Davis Village Facilities Main Fire Alarm Control Panel and the correct activation of the control points.
16. Coordinate with facility to provide some or all system testing after hours to avoid causing occupants to disregard fire alarm notification signals/messages.

3.6 FINAL INSPECTION AND ACCEPTANCE

- A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.
- B. Preliminary testing shall be performed to include all testing necessary to certify the correct operation of the entire fire alarm system installed under this project scope of work. Submission of certification of the fire alarm system is required prior to presenting the system for final inspection and acceptance testing.
- C. Preliminary testing shall include as a minimum a pre-functional test, functional performance test and an integrated system test. It is the contractor's responsibility to schedule, perform and document these tests. A representative from the VA Representative, Architect/Engineer and Authority Having Jurisdiction may monitor the preliminary tests but the presence of a representative of the VA Representative, Architect/Engineer and/or Authority Having Jurisdiction Representative is not required. No part of the fire alarm system is accepted at any point prior to the final acceptance test.
- D. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.4 TESTS and those required by NFPA 72. In addition, the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.
- E. Perform each electrical test and visual and mechanical inspection listed in NFPA 72, Chapter 14. Perform system testing as required by the VA Fire Marshal, VA COR and Engineer of Record. Certify compliance with test parameters. All tests shall be conducted under the direct

supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.

- F. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
- G. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
- H. Fire-alarm system will be considered defective if it does not pass all tests and inspections
- I. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.
- J. The Contractor shall submit the following at the end of their testing:
 - a. Signed copy of the NFPA 72 Record of Compliance form.
 - b. Statement that all tests required per Code and in these specifications has been completed.
 - c. Statement certifying that all work was completed per Code.
 - d. Systems status and programming report as described in 3.5.I, referenced below.
- K. As part of the closeout documents, Contractor to provide a systems status and programming report indicating each device's label and address and that they report back to the fire alarm control panel properly. This documentation must be part of the systems status and programming report.
- L. Grid ceiling mounted smoke detectors shall be centered in ceiling tile.
- M. Contractor to provide basic operating instructions, system operating matrix, and final floor plan drawing framed and mounted near the fire alarm control panel.
- N. Documentation
 - 1. Record Drawings:
 - a. The Contractor shall provide a complete and correct set of printed record drawings to be turned over to the Owner's Representative. This set of record drawings shall be in addition to all other drawings required. The printed record drawings shall be available at the time of the acceptance test. These drawings

shall not be marked or modified during the acceptance test.

2. Contractor shall prepare Pre-Functional Checklists and Functional Performance Test (FPT) procedures and execute and document results. All Pre-Functional Checklists and tests must be documented using specific, procedural forms in Microsoft Word or Excel software developed for that purpose. Prior to testing, Contractor shall submit those forms to the Architect/Engineer for review and approval.
3. Contractor shall provide Architect/Engineer with documentation that include at a minimum: Detailed Start-up procedures, Full sequences of operation, Operating and Maintenance data, Performance data, Functional Performance Test Procedures, Control Drawings, and details of Architect/Engineer and Owner-Contracted tests.
4. Contractor shall review and approve other relative documentation for impact on FPT's of the systems:
 - a. Shop Drawings and product submittal data related to systems or equipment to be commissioned. The Subcontractor responsible for the FPT shall review and incorporate comments from the Architect/Engineer.
 - b. Incorporate manufacturer's Start-up procedures with pre-functional checklists.
 - c. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPT's.
 - d. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation: Subcontractor performing the test will review the documentation prior to commencing with the scheduled FPT's.
5. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements.

3.7 INSTRUCTION

- A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:
 1. Six 1-hour sessions to engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the start of installation, 2 sessions at the completion of installation and 2 sessions 3 months after the completion of installation.

2. Four 2-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
 3. Three 8-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one 8-hour refresher session 3 months after the completion of installation.
- B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose-leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.
- C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.
- D. The training shall not take place until all system devices, annunciators and controls have been installed and certified operational by the certified fire alarm technician. The certifying technician shall be present throughout the training sessions.
- E. Contractor shall provide a site-specific list of service repair part numbers for system components. Standard manufacturer's service repair parts list is not acceptable. The exact parts used on site shall be listed with the appropriate service repair part number. The service part number shall be the only part number needed for correct replacement of the service part. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. The Training shall include "Hands-on" demonstration of the operation of all system components as part of this Scope of Work.

PART 4 - SCHEDULES

4.1 DIGITIZED VOICE MESSAGES:

- A. Digitized voice messages shall be provided for the single-story healthcare facility as an addition to the existing Trink Davis

Village. The messages shall be arranged with a 3 second alert tone, a "Code Red" message and a description of the fire alarm area (building number, floor, level, and smoke zone). A sample of such a message is as follows:

Alert Tone

Code Red

Building One, Second Floor, East Wing

Code Red

Building One, Second Floor, East Wing

Code Red

Building One, Second Floor, East Wing

4.2 LOCATION OF VOICE MESSAGES:

Upon receipt of an alarm signal from the building fire alarm system, the voice communication system shall automatically transmit a 3 second tone alert and a pre-recorded fire alarm message throughout the alarm of this single-story healthcare building addition to the existing Trink Davis Village Facility.

- - END - -

SECTION 28 52 31
EMERGENCY CALL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the complete and operating emergency call system, including instruments (stations), security strobe, stanchions and associated equipment here-in-after referred to as the "system".

1.2 RELATED WORK

- A. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 21, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- B. Lightning Protection: Section 26 41 00, FACILITY LIGHTNING PROTECTION.
- C. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- D. Requirements for personal safety and to provide a low impedance path for possible telecommunications ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- E. Voice and data distribution sub-systems, and associated hardware including telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, "patch" cables, and "break out" devices: Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
- F. 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.
- G. Extension of a voice communication switching and routing system: Section 27 31 31, EMERGENCY VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT EXTENSION.
- H. 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 provide:
1. Names, locations and contact information for three or more installations of operating emergency call station systems of comparable size and complexity previously installed by contractor performing satisfactorily for at least one year after final acceptance by user.
 2. Copies of applicable licenses.

B. Certifications:

1. Submit certification equipment provider has been OEM authorized distributor and service organization for three years.
2. Certification that technicians assigned to system are trained, qualified, and certified by OEM on engineering, installation, operation, and testing of system. Submit certificate of successful completion of OEM's installation/training school for every installing technician of equipment.
3. Submit OEM letter certifying authorization to pass OEM's warranty of equipment to Government.

C. Closeout Submittals:

1. Before the project closeout date submit:
 - a. Warranty certificate.
 - b. Evidence of compliance with requirements of governing authorities such as Low Voltage Certificate of Inspection.
 - c. Project record documents.
 - d. Instruction manuals and software that is a part of system.
2. Submit written notice that:
 - a. Contract Documents have been reviewed.
 - b. Project has been inspected for compliance with contract.
 - c. Work has been completed in accordance with the contract
3. Project Record Documents (As Builts):
 - a. Throughout progress of work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
4. Mark floor plans in pen to include the following:
 - a. Device locations with labels.
 - b. Conduit locations.
 - c. Equipment specific locations.
 - d. Wiring diagram.
 - e. Labeling and administration documentation.
 - f. Warranty certificate.
 - g. System test results.

1.4 QUALITY ASSURANCE

A. Supervision:

1. Assign a single project manager to this project to serve as point of contact for Government, General Contractor, and design professional.

2. Assigned individual to initiate and maintain discussion with General Contractor regarding the schedule for ceiling installation and complete cabling to meet that schedule.

B. Approvals: Contact Office of Telecommunications, Special Communications Team (0050P2H3) at (202) 461-5310 to have a VA Certified Telecommunications AHJ assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and FMS Teams.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevents damage, deterioration, and loss, including theft.
- B. Store products in original containers.
- C. Plan to store materials off site due to limited storage available on site.
- D. Do not install damaged products. Remove damaged products from the site and replace with new products.

1.6 WARRANTY

- A. Comply with FAR clause 52.246-21, except 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. Submit manufacturer warranty during the submittal process.
 2. Provide, free of charge, product firmware/software upgrades for a period of two years from date of acceptance by Government including any product feature enhancements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Coordinate features and select components to form an integrated system.
- B. Provide components and interconnections matched for optimum performance of specified functions.
- C. Equipment: Modular type, continuous duty rated.
- D. Weather-Resistant Equipment: Listed by a National Recognized Testing Laboratory (NRTL) for operation in damp or outdoor locations.

2.2 PERFORMANCE CRITERIA

- A. Provide functioning emergency call station system consisting of indoor or outdoor enclosures, stanchions, blue light and strobe lights, ADAAD compliant hands-free speakerphone communications devices and power supplies.

1. Conform to VAAR 852.236.91 and intent indicated for complete emergency communications network, recognizing that work may be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturer's methods of achieving specified results.
- B. Provide integrated blue light and strobe to identify unit location.
 1. To call attention to location of emergency communication unit, Blue light must always be lit.
 2. When emergency instrument is activated, the strobe flashes at 1 million candlepower and 60 fpm to draw attention to the location.
 3. Strobe continuously flashes until actively terminated by personnel receiving the call.
- C. Provide systems firmware by OEM with a proven history of product reliability and sole control over all source code.
- D. 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 EMERGENCY CALL STATION

- A. Provide dual button ring down, ADAAD compliant, multi-function, high strength, vandal-resistant emergency instrument. Include high quality, and vandal-resistant, hands free communications device capable of mounting in an integrated wall mount enclosure assembly or free-standing emergency phone stanchion.
- B. Standard Features:
 1. Three number dialing capability.
 2. Programmable from a remote location.
 3. Two input relays.
 4. Two output relays.
 5. Remote speaker volume adjustment.
 6. Capable of playing two digitally stored voice messages.
 7. Programmable passwords.
 8. Capable of using interchangeable faceplates.
 9. Silent dial out.
 10. Output sound level >80 dB at 1 meter for normal conversation.
 11. Waterproof speaker.
 12. Waterproof microphone.
 13. Auto answer and auto shut-off.

14. Operating temperatures of -40 degrees to +65 degrees C (-40 degrees F to +150 degrees F).
 15. Conformal coated Speakerphone electronics to withstand harsh environments.
- C. Unit must have the following additional features:
1. Interface with facility's Emergency Voice Switching and Security Management System via "home run" communication cables.
 2. Vandal resistant stainless steel faceplate 12-gauge No.4 brushed stainless steel.
 3. Metal buttons.
 4. Phone line powered; no local power supply or battery backup required. Power provided by system headend unit.
 5. LED indicator for hearing impaired.
 6. Cast metal raised letter and Braille signage for ADAAD compliance.
 7. Auto-answer that allows security to monitor and initiate calls with Government provided phone.
 8. Auxiliary input and output programmable to integrate with video surveillance and security management system (SMS).
- D. Tamper-resistant Fasteners: Provide fasteners to enter unit only with proprietary wrench available from OEM of unit. Other types of fasteners will not be permitted for installation due to abundance of non-proprietary tools available for their removal.
- E. Rain and ice tight and insect resistant when assembled.
- F. When push button is activated:
1. Immediately and automatically dial security SMS console.
 2. Cause blue strobe light to flash.
 3. Activate output to associated video surveillance cameras.
 4. Provide visual indication, on Security Service's SMS Console Display Panels, to identify mapped location of activated unit.
- G. Connect via RJ-45 plug to twisted pair phone line to SMS console VoIP extension, when specifically accepted by SMCS 0050P2H3.
- H. Electrical:
1. Provide quick-disconnect terminals with plug and receptacle attachments for easy service or removal electrical components.
 2. Conceal wiring within unit so is not to be visible from outside.
 3. Provide 24 VAC under normal operation.
 4. Surge protect dry pair telephone line and lightning ground entire unit.

2.4 BLUE STROBE LIGHTS

- A. Provide 1 million candlepower LED strobe light and a vivid blue area light, which serves to identify unit from great distances.
- B. Flash rate of no less than 60 flashes per minute
- C. Covered by a polycarbonate, prismatic refractor that distributes light in a horizontal pattern, making flash visible at great distances.
- D. Inaccessible to vandals.
- E. Weather resistant.
- F. Program to automatically activate when "Emergency" button is touched and flash until receiving party (SMS Console Operator) of call deactivates it. Strobe cannot be deactivated at unit.
- G. Provide 24VAC, 60Hz power for blue light, strobe, and faceplate light.
- H. Blue light and strobe must be controlled via emergency instrument by an auxiliary output.

2.5 STANCHION

- A. Wall Mount:
 - 1. 30.8 cm (12-1/8 inches) wide x 81.9 cm (32-1/4 inches) high x 19.1 cm (7-9/16 inches) deep.
 - 2. Vandal resistant, 2.5 mm (12-gauge) No.4 vertical brushed stainless steel designed to withstand prolonged exposure to harsh environments.
 - 3. Blue light and strobe mounting location at top of unit, housed in vandal resistant, blue polycarbonate refractor housing. This blue light and strobe further enclosed in a clear polycarbonate security enclosure.
 - 4. Weight: Maximum 34.01 kg (75 lbs.).
 - 5. Opening: Flush mount ADAAD-compliant, hands-free emergency instrument into wallmount enclosure.
 - 6. Mounting:
 - a. Fasten security call stations to wall with anchors and bolts as recommended by OEM or otherwise indicated.
 - b. Provide custom backbox from OEM to flush mount in path of egress as required by ADAAG.
- B. Free Standing:
 - 1. Concentric steel cylinder (bollard) with a 222 mm (8-3/4 inch) diameter, a 6 mm (1/4 inch) wall thickness and a height of 2133 mm (84 inches).

2. Blue light and strobe located at top of unit with deep blue polycarbonate prismatic refractor that distributes light in a horizontal pattern, making the flash visible even at great distances.
3. Capability of mounting ADAAD-compliant, hands-free emergency instrument into pole mount housing.
4. Weight: Maximum 124.73 kg (275 lbs).
5. Secure free standing stanchions as shown on drawing details.

C. Graphics:

1. Cut from an engineering grade reflective vinyl for high visibility and legibility, with seven-year durability.
2. Provide standard graphics text "Emergency". In Standard colors reflective white, reflective blue and reflective black.

D. Finish:

1. Wall mounted stanchion: stainless steel uniform and free of visible and mechanical defects.
2. Free standing stanchion: Finished with a coating process graffiti, water, hostile environment and UV resistant.

2.6 SECURITY CALL STATION POWER SUPPLY

A. Provide power to operating and management console circuits and Multiple Call Instruments:

1. Steel, NEMA 1 rated enclosure.
2. AC power indicator with power On/Off switch with corresponding light.
3. 120 or 230 VAC selectable input.
4. 24VAC output and 28VAC output (for longer runs).
5. Main fused input.
6. 10A current capacity.
7. Minimum 8 fused outputs.
8. Input wire size 12-16 gauge.
9. Output wire size 12-22 gauge stranded wire.

B. Security Call Station Cable:

1. Meet or exceed OEM's requirement.
2. Power cable: Minimum 14 AWG wire or as otherwise accepted home run from power supply to each call instruments.
3. Cables installed underground in underground conduits: Rated for direct burial installation.

4. Cables inside Building: Plenum rated in plenum spaces; riser rated in other areas.

2.7 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. Provide a backup battery or a UPS for system head end at Security Service SMS console or its associated TR 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 one hour. Connect system to facility's Critical Generator Power Service.
 1. As an alternative solution, utilize facility telephone system UPS (if it is present) to meet this requirement at head end location, only when specifically accepted by COR.
 2. Obtain specific direction, in writing, from COR prior to any attachments or connection to facility's existing telephone system (if it exists).
- B. Provide UPS for active system components including:
 1. Head end.
 2. Master call instruments.
 3. Remote call instruments.
 4. Police SMS console.
 5. Emergency/Disaster control console (when made an extended control and monitoring part of system).

2.8 FINISHES

- A. Finishes for any exposed work such as plates, racks, panels, towers, enclosures, intercom stations, etc. must be accepted by design professional, COR and SMCS 0050P2H3.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review and coordinate with cabling trade contractor for location of security emergency call equipment in TRs.
- B. Before beginning work, verify location, quantity, size and access for the following:
 1. AC power circuits provided for systems.
 2. Pull boxes, back boxes, wire troughs, cable trays/ladders, conduit stubs and other related infrastructure for systems.
 3. System components installed by others.
 4. Overhead supports and rigging hardware installed by others.
 5. Telecommunications grounding busbar connected to telecommunications grounding system.

6. Immediately notify Government, and design professional of any discrepancies.

3.2 INSTALLATION

A. General:

1. Install work neatly, 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 his work during construction phase up until final acceptance by Government.
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 emergency call stations, stanchions, system cables, etc.
 - a. Support loads with mounts, fasteners, attachments and attachment points with a safety factor of at least 5:1.
 - b. Do not impose weight of equipment or fixtures 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.
5. 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.
6. Cutting and Patching:
 - a. Patch and paint any wall or surface that has been disturbed by execution of work.
 - b. 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.
 - c. Do not damage or endanger a portion of Work, or partially completed construction of Government or separate contractors, by cutting, patching or otherwise altering such construction, or by excavation. Do not cut or otherwise alter such construction by

Government or a separate contractor except with written consent of Government.

- d. Where coring of in-place concrete is required, clearly identify location of such coring in the field and have location accepted by COR prior to commencement of coring.
7. Keep work areas clear of debris and clean daily at completion of work.

B. Wiring Practice:

1. Comply with requirements for raceways and boxes specified in Division 28, Section 28 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
2. Execute wiring in strict adherence to National Electrical Code, applicable local building codes and standard industry practices.
3. Classify wiring according to the following low voltage signal types:
 - a. Voice audio.
 - b. Low voltage DC control or power (less than 48VDC).
4. Where raceway is conduit, wiring of differing classifications must be run in separate conduit.
5. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share same enclosure must be mechanically partitioned and separated by minimum 102 mm (4 inches). Where cables of differing classifications cross, cross cabling perpendicular to one another.
6. Do not splice wiring anywhere along entire length of run.
7. Ensure cables are insulated and shielded from each other and from raceway for entire length of run.
8. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs.
9. Do not bend wires to less than radius recommended by manufacturer.
10. 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.
11. Use wire pulling lubricants and pulling tensions recommended by OEM.
12. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
13. Do not use tape-based or glue-based cable anchors.
14. Ground shields and drain wires as indicated or recommended by OEM.
15. 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. If specified terminal blocks are not designed for rack mounting, utilize 19 mm (3/4 inch) plywood or 3 mm (1/8 inch) thick aluminum plates/blank panels as a mounting surface.
 - c. Do not mount terminal block on bottom of rack.
 - d. Employ permanent strain relief for any cable with an outside diameter of 25.4 mm (1 inch) or greater.
16. Make connections as follows:
- a. Use mechanical connectors appropriate to application.
 - b. For crimp-type connections, use only tools that are specified by manufacturer for the application.
 - c. Use only insulated spade lugs on screw terminals. Size spade lugs to fit wire gauge; do not exceed two lugs per terminal.
 - d. Wire connectors or electrical tape connections are not permitted for any application.
- C. Cable Installation: In addition to mandatory infrastructure requirements provided under, Section 27 15 00, STRUCTURED CABLING, adhere to the following additional practices:
1. Support cable on maximum 610 mm (2 feet) centers. Acceptable means of cable support are cable tray or conduit. Wrap cable bundles loosely to cable tray with plenum rated hook and loop straps. Plastic tie wraps are not permitted as a means to bundle cables.
 2. Run cables parallel to walls.
 3. Do not lay cables on top of luminaires, ceiling tiles, mechanical equipment, or ductwork. Maintain 61 cm (2 feet) clearance from shielded electrical apparatus.
 4. Test each cable after the total installation is complete. Document every test result including failures. Remedy any cabling problems or defects; this includes re-pull of new cable as required.
 5. Terminate cables on both ends per industry and OEM's recommendations.
 6. 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 the floor until you are ready to terminate.

7. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps are not permitted.
 8. Elude runs through structural members or cable in contact with pipes, ducts, or other potentially damaging items.
 9. Separation of Wires: (Refer to Raceway Installation)
 - a. Separate communications cable, and power wiring runs.
 - b. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 30.5 cm (12 inches) apart for adjacent parallel power and telephone wiring.
 - c. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- D. Labeling:
1. Permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
 2. Permanently label cables at each end, including intra-rack connections with, electronically printed labels of type which include a clear protective wrap.
 3. Provide printed labels at both ends of cables.
 4. Ensure equipment has appropriate NRTL Label, for product category it will perform. Equipment not bearing NRTL label will not be permitted as part of system, and contractor must provide listed replacement equipment with NRTL label.
- E. System Programming: Provide programming required for a complete and operational system. Coordinate programming parameters with COR and FMS Engineer.
- F. Fireproofing:
1. Fireproof the openings where cables penetrate fire rated walls, floors and ceilings.
 2. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls. After cabling installation is complete, install fireproofing 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.
- G. Grounding:

1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
2. Provide telecommunications grounding system per Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

3.3 FIELD QUALITY CONTROL

A. Intermediate Testing:

1. After completion of 25 percent of installation of equipment, including one emergency call 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.
2. Arrange for inspection and test to be conducted by a factory-certified representative and witnessed by Government and SMCS 0050P2H3.
3. An identical inspection must be conducted between 65 and 75 percent of system construction phase; COR has authority to waive this requirement.

B. Pretesting:

1. Upon completing installation of system:
 - a. Align, balance, and pretest entire system under full operating conditions.
 - b. Verify (utilizing accepted test equipment) system is operational and meets performance requirements of this standard.
 - c. Verify that system functions are operational, and no unwanted aural effects, (i.e. signal distortion, noise pulses, glitches, audio hum, poling noise, etc.) are present. Pretest each of the following locations:
 - 1) Networked locations.
 - 2) System trouble reporting.
 - 3) System electrical supervision.
 - 4) UPS operation.
2. Provide COR with recorded system pretest measurements and certification that system is ready for formal acceptance.

C. Acceptance Test:

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1. After system has been pretested and contractor has submitted pretest results and certification to COR, schedule an acceptance test date by giving COR thirty days' written notice prior to date acceptance test is expected to begin. Include the duration of time for the test in the notification.
2. Test system in the presence of Government, SMCS 0050P2H3 and an OEM-certified representative.
3. Test utilizing accepted test equipment to certify proof of performance.
4. Perform only operator adjustments required to show proof of performance during test.
5. Demonstrate and verify that installed system complies with requirements of this section, under operating conditions.
6. Rate system as either acceptable or unacceptable at conclusion of test.
7. Terminate acceptance test of system for failure of any part of system that precludes completion of system testing, and which cannot be repaired in four hours. For repeated failures that result in a cumulative time of eight hours to affect repairs, Government will declare entire system to be unacceptable.
8. Reschedule retesting of unacceptable systems at the convenience of Government.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:
 - a. Prepare a system inventory including available spare parts. Check each item of installed equipment to ensure appropriate NRTL certification labels are affixed.
 - b. Formally inventory and review system diagrams, record drawings, equipment manuals, electronic drawing files, intermediate, and pretest results on portable storage drives.
 - c. Terminate testing for failure of system to meet requirements of this section.
2. Operational Test:
 - a. After physical and mechanical inspection, check equipment to verify system meets performance requirements. Use sound level meter to accomplish this requirement.
 - b. Individual Item Test: Government will select individual items of equipment for detailed proof of performance testing until 100

percent of system is tested and found to meet or exceed minimum requirements of specifications.

3. Test Conclusion: Government will accept results of the test or require additional testing on reported deficiencies and shortages. Retesting to comply with these specifications must be done at Government's convenience and contractor's expense.

E. Acceptable Test Equipment:

1. Provide test equipment with a calibration tag of an acceptable calibration service dated not more than twelve months prior to test.
2. As part of submittal, a test equipment list must be furnished that includes make and model number of the following type of equipment:
 - a. Signal Level Meter.
 - b. Volt-Ohm Meter
 - c. Sound Pressure Level (SPL) Meter.

3.4 CLEANING

- A. Prior to final inspection and acceptance of work, remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and thoroughly clean work area.

3.5 TRAINING

- A. Provide thorough training of security staff assigned to units receiving communications from emergency call station system equipment. Implement training from security console officer's perspective, and likewise, for any person whose specific responsibilities include answering emergency calls and dispatching security response, provide operational training from their perspective. Use a separate training room that allows this type of individualized training utilizing an in-service training unit, prior to cut over of new system.
- B. Provide the following minimum training:
 1. 32 hours during opening week for security staff - both day and night shifts.
 2. 24 hours for supervisors and system administrators.

3.6 MAINTENANCE

- A. Provide COR the ability to contact contractor and 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 logistic assistance capability to Government.

B. Response Time, during Warranty Period, for Security Emergency Call

System Trouble Calls:

1. A standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.
2. Respond and correct on-site trouble calls, during the standard work week:
 - a. A routine trouble is considered a trouble which reports a single station or interface point is inoperable. Routine trouble call within one working day (12 hours) of its report.
 - b. An emergency trouble is considered a trouble which causes a sub system (ward), distribution point, terminal cabinet, to be inoperable at any time. Emergency trouble call within two hours of its report.
 - c. A catastrophic trouble is considered a trouble which a major portion of system fails; or, an entire system failure has happened. Catastrophic trouble call within one hour of it report.

- - - E N D - - -

SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:

1. Site preparation.
2. Excavation.
3. Underpinning.
4. Filling and backfilling.
5. Grading.
6. Soil Disposal.
7. Clean Up.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D698.
2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from the subsurface exploration of the Geotechnical Engineering Report and design requirements, excavate to acceptable strata subject to COR's approval.

B. Building Earthwork: Earthwork operations required in area enclosed by a line located 1500 mm (5 feet) outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.

- C. Trench Earthwork: Trenchwork required for utility lines.
- D. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.
- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D6938.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the COR based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.

- O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- R. Contaminated soils: Soil that contains contaminants as defined and determined by the COR or the Government's testing agency.

1.3 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements : Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 32 90 00, PLANTING.
- F. Site preparation: Section 02 41 00, DEMOLITION.
- G.

1.4 CLASSIFICATION OF EXCAVATION:

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.
- B. Classified Excavation: Removal and disposal of all material not defined as Rock.
- C. Rock Excavation:

1. Trenches and Pits: Removal and disposal of solid, homogenous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be excavated with a late-model, track-mounted hydraulic excavator; equipped with a 1050 mm (42 inch) wide, short-tip-radius rock bucket; rated at not less than 103 kW (138 hp) flywheel power with bucket-curling force of not less than 125 kN (28,090 lbf) and stick-crowd force of not less than 84.5 kN (19,000 lbf); measured according to SAE J-1179. Trenches in excess of 3000 mm (10 feet) wide and pits in excess of 9000 mm (30 feet) in either length or width are classified as open excavation.
2. Open Excavation: Removal and disposal of solid, homogenous, interlocking crystalline material firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be dislodged and excavated with a late-model, track-mounted loader; rated at not less than 157 kW (210 hp) flywheel power and developing a minimum of 216 kN (48,510 lbf) breakout force; measured according to SAE J-732.
3. Other types of materials classified as rock are unstratified masses, conglomerated deposits and boulders of rock material exceeding 0.76 m³ (1 cubic yard) for open excavation, or 0.57 m³ (3/4 cubic yard) for footing and trench excavation that cannot be removed by rock excavating equipment equivalent to the above in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted.
4. Blasting: Removal and disposal of solid, homogenous, interlocking crystalline material firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be removed with conventional methods may not be performed by blasting.
5. Definitions of rock and guidelines for equipment are presented for general information purposes only. The Contractor is expected to use the information presented in the Geotechnical Engineering Report to evaluate the extent and competency of the rock and to determine both quantity estimations and removal equipment and efforts.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

- A. Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross

sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation for rock, authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.7 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Furnish to COR:
 - 1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
 - 2. Soil samples.
 - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - b. Laboratory compaction curve in accordance with ASTM D698 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - c. Test reports for compliance with ASTM D2940 requirements for subbase material.
 - d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including

surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.

e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

3. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Notification of encountering materials of an archaeological nature. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T99-10 Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-10 Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop

C. American Society for Testing and Materials (ASTM):

C33-03 Concrete Aggregate

D448-08 Standard Classification for Sizes of Aggregate for Road and Bridge Construction

D698-07e1 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))

D1140-00 Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-07 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method

D1557-09 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))

- D2167-08 Standard Test Method for Density and Unit
Weight of Soil in Place by the Rubber Balloon
Method
- D2487-11 Standard Classification of Soils for
Engineering Purposes (Unified Soil
Classification System)
- D2940-09 Standard Specifications for Graded Aggregate
Material for Bases or Subbases for Highways or
Airports
- D6938-10 Standard Test Method for In-Place Density and
Water Content of Soil and Soil-Aggregate by
Nuclear Methods (Shallow Depth)
- D. Society of Automotive Engineers (SAE):
- J732-07 Specification Definitions - Loaders
- J1179-08 Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Pursuant to Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-mm) and 36 CFR Part 7 - Protection of Archeological Resources, all fill material must come from sources which have been assessed for potential archeological resources. Documentation must be provided that assures VA that the extraction and utilization of the fill material will not adversely impact known archaeological or tribally-associated sites. Material approved from on site or off site sources having a minimum dry density of 1760 kg/m³ (110 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-

inch) sieve and not more than 12 percent passing a 75- μ m (No. 200) sieve, per ASTM D2940;.

- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75- μ m (No. 200) sieve.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.
- F. Granular Fill:
1. Under concrete slab, - granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C 33 with a maximum of 3 percent by weight passing ASTM D 1140, 75 micrometers (No. 200) sieve, and no more than 2 percent by weight passing the 4.75 mm (No. 4) or coarse aggregate Size 57, 67, or 77.
 2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D2940.
- G. Requirements for Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method 5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site.
- H. Buried Warning and Identification Tape: Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3

inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:

Red: Electric
Yellow: Gas, Oil, Dangerous Materials
Orange: Telephone and Other Communications
Blue: Water Systems, Geothermal Systems
Green: Sewer Systems
White: Steam Systems
Gray: Compressed Air

- I. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.
- J. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m (3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.
- K. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center .

- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by COR. Remove materials from Medical Center. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with latest issue of, "American Standard for Nursery Stock" of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by COR. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m³ (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.

- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center.
- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
 2. Locations of existing and proposed elevations indicated on plans , except spot elevations, are approximate. from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour lines and may be approximate. Contractor is responsible to notify COR of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify COR of any differences between existing or constructed grades, as compared to those shown on the plans.
 3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.
 4. Finish grading is specified in Section 32 90 00, PLANTING.
- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all

removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the COR, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.

1. Design of the temporary support of excavation system is the responsibility of the Contractor. The Contractor shall submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheet piling shall be removed as excavations are backfilled, in a manner to prevent caving.
2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the COR.
3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall underpin the existing foundation, per Section 3.3 provide a concrete fill support in compliance with specifications Section 31 23 23.33, FLOWABLE FILL, under disturbed foundations, as directed by COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COR.
5. The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The

Geotechnical Engineer shall update the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and COR of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the COR at any time throughout the contract duration.

- B. Excavation Drainage: Operate pumping equipment , and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from COR. Approval by the COR is also required before placement of the permanent work on all subgrades. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the COR.
- E. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
 2. Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade with six passes of a dump truck loaded with 6 cubic meters (4 cubic yards) of soil 13.6 meter tons (15 ton), pneumatic-tired roller. Operate the truck in a systematic

manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour (2 1/2 to 3 1/2 mph). When proof rolling, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the COR a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the COR. Rutting or pumping of material shall be undercut as directed by the COR to a depth of 24 inches and replaced with fill and backfill select material. Maintain subgrade until succeeding operation has been accomplished.

F. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft materials to a solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified.
6. Slope grades to direct water away from excavations and to prevent ponding.
7. Capillary water barrier (granular fill) under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.
8. Ensure that footing subgrades have been inspected and approved by the COR prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the COR. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

G. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
 - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.

- c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
- d. Length of open trench in advance of piping laying shall not be greater than is authorized by COR.
- e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
- f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
- g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
 - 1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional

significance such as coral, slag, cinders, crushed stone, and crushed shells.

- 2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

2. Sanitary and storm sewer trenches:

- a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe up to and including 300 mm (12 inches) diameter, and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - 1) Bed bottom quadrant of pipe on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
 - 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
 - 2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
- c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
- d. Use granular fill for bedding where rock or rocky materials are excavated.
- e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade

- f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
- g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
- 1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
 - 2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
 - 3) Clean, coarse-grained sand classified as _____ in accordance with ASTM D2487 for bedding and backfill.
 - 4) Clean, coarsely graded natural gravel, crushed stone or a combination thereof in accordance with ASTM D2487 for bedding

and backfill as indicated. Maximum particle size shall not exceed 75 mm (3 inches).

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H. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, under the direction of the COR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.
- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:

- 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
- 2) Walks: Plus or minus 25 mm (1 inch).
- 3) Pavements: Plus or minus 13 mm (1 inch).

- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

3.3 UNDERPINNING:

A. Design of the underpinning system is the responsibility of the Contractor and should be designed by a registered professional engineer and is subject to review and approval by the COR. Underpinning of existing building foundations, as indicated on structural drawings, or where excavation undermines existing foundations, shall be accomplished in the following manner:

1. Make general excavation for new construction, where new foundations are to be below existing foundations, to elevation of new foundations (or sized stone subbase), maintaining a 45 degree sloped berm.
2. For underpinning pits, underpin existing wall foundations by excavating 1200 mm (4 feet) wide pits to depth shown on drawings skipping 3 sections at any one time so as to maintain support for wall at all times.
3. Underpin intervening sections one at a time; no adjacent sections shall be underpinned until concrete in adjacent sections shall have reached 20 MPa (2500 psi) strength and have been dry packed with non-shrink grout to obtain positive bearing. Sheet and brace underpinning pits if soil will not stand on a vertical cut during this operation, or as required for safety of workmen. Repack any voids behind sheeting to prevent sloughing which could cause settlement of existing foundations. Contractor performing this portion of work shall have been prequalified by COR as having previously performed successfully this type of work or will demonstrate his capability for successfully performing this work. It shall be sole responsibility of the Contractor to guard against objectionable movement or settlement and to preserve integrity of existing structures.
4. The tip elevation of the underpinning pits shall be a minimum of 900 mm (3 feet) below the adjacent excavation elevation.
5. Subgrades at the tip of the underpinning pit shall be clean, dry, and free of debris and shall be observed by the COR prior to concrete placement.

6. Concrete shall not be free fall greater than 3000 mm (10 feet) into the pit.

3.4 FILLING AND BACKFILLING:

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by COR.
- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of COR. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:
1. Fills, Embankments, and Backfill

- a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with ASTM D698 95 percent.
 - b. Curbs, curbs and gutters, ASTM D698 95 percent.
 - c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698 95 percent.
 - d. Landscaped areas, top 400 mm (16 inches), ASTM D698 85 percent.
 - e. Landscaped areas, below 400 mm (16 inches) of finished grade, ASTM D698 90 percent.
2. Natural Ground (Cut or Existing)
- a. Under building slabs, steps and paved areas, top 150 mm (6 inches), ASTM D698 95 percent.
 - b. Curbs, curbs and gutters, top 150 mm (6 inches), ASTM D698 95 percent.
 - c. Under sidewalks, top 150 mm (6 inches), ASTM D698 95 percent.
- D. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor or from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.
- E. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the COR sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing

adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 GRADING:

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade shall be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.
- G. Finish subgrade in a condition acceptable to COR at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Medical Center property. Stockpile or spread soil as directed by COR.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- C. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- D. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- E. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center Cemetery Property .

----- E N D -----

SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subbase for concrete pavements.
2. Combination curbs and gutters
3. Pedestrian Pavement: Walks, grade slabs, pedestrian crossings, wheelchair curb ramps, patios.
4. Vehicular Pavement: Driveways, parking lots, and loading docks .
5. Equipment Pads: transformer and generator pads.

1.2 RELATED REQUIREMENTS

- A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Step Nosings and Railings: Section 05 50 00, METAL FABRICATIONS.
- C. Subgrade Preparation and Subbase Compaction: Section 31 20 00, EARTHWORK.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
 2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
- C. American Concrete Institute (ACI):
 1. 305R-10 - Guide to Hot Weather Concreting.
 2. 306R-10 - Guide to Cold Weather Concreting.
- D. American National Standards Institute (ANSI):
 1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).
- E. ASTM International (ASTM):
 1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. C33/C33M-16 - Concrete Aggregates.
5. C94/C94M-16 - Ready Mixed Concrete.
6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
7. C150/C150M-16 - Portland Cement.
8. C171-16 - Sheet Materials for Curing Concrete.
9. C260/C260M-10a - Air Entraining Admixtures for Concrete.
10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.
11. C494/C494M-15a - Chemical Admixtures for Concrete.
12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Inspection and Testing Agency.
 - d. Contractor.
 - e. Installer.
 - f. Other installers responsible for adjacent and intersecting work.
 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.

- d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show size, configuration, and fabrication and installation details.
 2. Show reinforcing.
 3. Include jointing plan for concrete pavements, curbs and gutters.
- C. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Installation instructions.
- D. Samples:
 1. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.
 2. Colored Concrete Panel: As specified in Section 09 06 00, SCHEDULE FOR FINISHES, with mix data.
- E. Test reports: Certify products comply with specifications.
 1. Concrete materials.
 2. Select subbase materials.
 3. Field test reports.
- F. Certificates: Certify products comply with specifications.
 1. Expansion joint filler.
 2. Reinforcement.
 3. Curing materials.
 4. Concrete protective coating.
- G. Qualifications: Substantiate qualifications comply with specifications.
 1. Installer with project experience list .
 2. Land surveyor.
- H. Concrete mix design.
- I. Select subbase job-mix design.

- J. Proposed hot and cold weather concreting methods.
- K. Land surveyor's construction staking notes, before placing concrete.
 - 1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.
- C. Preconstruction Testing:
 - 1. Engage independent testing laboratory to perform tests and submit reports.
 - a. Deliver samples to laboratory in number and quantity required for testing.
 - 2. Concrete mix design.
 - 3. Select subbase job-mix design. Report the following:
 - a. Material sources.
 - b. Gradation.
 - c. Plasticity index.
 - d. Liquid limit.
 - e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

- A. Deliver steel reinforcement to prevent damage.
- B. Before installation, return or dispose of distorted or damaged steel reinforcement.
- C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

- A. Hot Weather Concreting Procedures: ACI 305R.
- B. Cold Weather Concreting Procedures: ACI 306R.
 - 1. Use non-corrosive, non-chloride accelerator admixture.
 - 2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II.
- B. Pozzolans:
 - 1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
 - 2. Slag: ASTM C989/C989M; Grade 100.
 - 3. Silica Fume: ASTM C1240.
- C. Coarse Aggregate: ASTM C33/C33M.
- D. Fine Aggregate: ASTM C33/C33M.
- E. Mixing Water: Fresh, clean, and potable.
- F. Air-Entraining Admixture: ASTM C260/C260M.
- G. Chemical Admixtures: ASTM C494/C494M.
- H. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, deformed.
- I. Welded Wire Fabric: ASTM A1064/A1064M, plain; deformed; Grade 485 (70); sized as indicated.
- J. Expansion Joint Filler: ASTM D1751.
- K. Sheet Materials for Curing Concrete: ASTM C171.
- L. Color Pigment: ASTM C979/C979M, colored and white powder pigments.

2.2 SELECT SUBBASE

- A. Subbase: AASHTO M147; Grade C.
 - 1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

SUBBASE GRADING REQUIREMENTS

Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

B. Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

2.3 FORMS

- A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.
1. Plywood: Exterior grade, free of defects and patches on contact surface.
 2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
 3. Form Coating: As recommended by Architect/Engineer.
- B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.
1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.
- C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

- A. Concrete curing materials, conform to one of the following:
1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
 2. Sheet Materials for Curing Concrete: ASTM C171.
 3. Curing Compound: ASTM C309, Type 1 clear; liquid membrane forming type, without paraffin or petroleum.

2.5 CONCRETE MIXES

- A. Design concrete mixes according to ASTM C94/C94M, Option C.
- B. Concrete Type: Air-entrained . See Table I.

TABLE I - CONCRETE TYPES					
Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*
Footnotes:					
1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f'c.					
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.					
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.					

- C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP	
APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

2.6 ACCESSORIES

- A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.
- B. Maintain equipment and tools in satisfactory working condition.
- C. Sealants:

1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
 2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.
- D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.
- D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

- A. Placing:
 1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
 2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
 3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.
- B. Compaction:
 1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
 2. Maintain subbase at optimum moisture content for compaction.
 3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK.
- C. Subbase Tolerances:
 1. Variation from Indicated Grade: Maximum 9 mm (3/8 inch).
 2. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).
- D. Protection:
 1. Protect subbase from damage until concrete is placed.
 2. Reconstruct damaged subbase before placing concrete.

3.3 SETTING FORMS

A. Form Substrate:

1. Compact form substrate to uniformly support forms along entire length.
2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:

1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
2. Remove forms when removal will not damage concrete and when required for finishing.
3. Clean and oil forms before each use.
4. Correct forms, when required, immediately before placing concrete.

C. Land Surveyor: Establish control, alignment, and grade for forms and slip forming machine operations .

1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.

D. Form Tolerances:

1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

- A. Keep reinforcement clean from contamination preventing concrete bond.
- B. Install reinforcement shown on drawings.
- C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.
- D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

- A. Place joints, where shown on approved submittal Drawings.
 1. Conform to details shown.
 2. Install joints perpendicular to finished concrete surface.
- B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown on approved submittal Drawings.
- B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.
- C. Provide butt-type joint with dowels in curb and gutter at planned joint locations.
- D. Provide keyed joints with tie bars when joint occurs in middle third of planned curb and gutter joint interval.

3.7 CONTRACTION JOINTS

- A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.
- B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.
 - 1. Keep plates in place until concrete can hold its shape.
- C. Finish joint edges with edging tool.
- D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

- A. Form expansion joints with expansion joint filler of thickness shown on drawings.
 - 1. Locate joints around perimeter of structures and features abutting site work concrete.
 - 2. Create complete, uniform separation between structure and site work concrete.
- B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.
- C. Cut and shape material matching cross section.
- D. Anchor with approved devices to prevent displacing during placing and finishing operations.
- E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

- A. Preparation before Placing Concrete:
 - 1. Obtain Contracting Officer's Representative approval.
 - 2. Remove debris and other foreign material.
 - 3. Uniformly moisten substrate, without standing water.

- B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.
- C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.
 - 1. Vibrate concrete against forms and along joints.
 - 2. Avoid excess vibration and handling causing segregation.
- D. Place concrete continuously between joints without bulkheads.
- E. Install construction joint in concrete placement suspended for more than 30 minutes.
- F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

- A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.
- B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.
- C. Strike concrete surface to proper section ready for consolidation.
- D. Consolidate concrete by tamping and spading or with approved mechanical finishing equipment .
- E. Finish concrete surface with wood or metal float.
- F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

- A. Deposit concrete as close as possible to its final position.
- B. Place concrete continuously between construction joints without cold joints.
- C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.
- D. Finish concrete surface to elevation and crown shown on drawings.
- E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.
- F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.
- G. Curb-Forming Machines: Curb-forming machines for constructing integral curbs curbs and gutter will be approved based on trial use on the project. When equipment produces unsatisfactory results, discontinue

use of the equipment at any time during construction and accomplish work by hand method construction. Remove unsatisfactory work and reconstruct full length between regularly scheduled joints. Dispose of removed portions off the project site.

3.12 FORM REMOVAL

- A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.
- B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.13 CONCRETE FINISHING - GENERAL

- A. Follow operation sequence below, unless otherwise indicated on Drawings:
 - 1. Consolidating, floating, striking, troweling, texturing, and joint edging.
- B. Use edging tool with 6 mm (1/4 inch) radius, unless otherwise shown on Drawings .
- C. Keep finishing equipment and tools clean and suitable for use.

3.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

- A. Walks, Grade Slabs, Wheelchair Curb Ramps, Terraces, Healing Gardens :
 - 1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
 - 2. Finish slab edges and formed transverse joints with edger.
 - 3. Broom surfaces transverse to traffic direction.
 - a. Use brooming to eliminate flat surface produced by edger.
 - b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
 - 4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
 - 5. Paving Tolerances:
 - a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
 - b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
 - 6. Replace paving within joint boundary when paving exceeds specified tolerances.

- B. Step Treads, Risers and Sidewalls: Finish as specified for pedestrian pavement, except as follows:
 - 1. Remove riser forms sequentially, starting with top riser.
 - 2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round nosing; use inside edger to finish bottom of riser.
 - 3. Apply uniform brush finish to treads, risers, and sidewall.
 - a. Apply stiff brush finish to treads to provide slip resistant surface complying with ANSI B101.3.
 - 4. Step Tolerance:
 - a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

3.15 CONCRETE FINISHING - VEHICULAR PAVEMENT

- A. Align finish surfaces where new and existing pavements abut.
- B. Longitudinally float pavement surface to profile and grade indicated on drawings.
- C. Straighten surface removing irregularities and maintaining specified tolerances while concrete is plastic.
- D. Finish pavement edges and joints with edging tool.
- E. Broom finish concrete surface after bleed water dissipates and before concrete hardens.
 - 1. Broom surface transverse to traffic direction.
 - a. Use brooming to eliminate flat surface produced by edger.
 - b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep profile.
- F. Pavement Tolerances:
 - 1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
 - 2. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
- G. Replace paving within joint boundary when paving exceeds specified tolerances.

3.16 CONCRETE FINISHING - CURBS AND GUTTERS

- A. Round edges of gutter and top of curb with edging tool.
- B. Gutter and Curb Top:
 - 1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.

2. Finish surfaces, while still plastic, longitudinally with bristle brush.
- C. Curb Face:
 1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
 2. Brush curb face, while still plastic, matching gutter and curb top.
- D. Curb and Gutter Tolerances: Except at grade changes or curves.
 1. Variation from Indicated Plane and Grade:
 - a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
 - b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).
- E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.
- F. Correct depressions causing standing water.

3.17 CONCRETE FINISHING - EQUIPMENT PADS

- A. Strike pad surface to elevation shown on Drawings.
- B. Provide smooth, dense float finish, free from depressions or irregularities.
- C. Finish pad edges with edger.
- D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.
- E. Pad Tolerances:
 1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
 2. Variation from Indicated Elevation: Maximum 6 mm (1/4 inch).
 3. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
- F. Replace pads when pads exceed specified tolerances.

3.18 SPECIAL FINISHES

- A. Exposed Aggregate Finish:
 1. Prepare concrete base 10 to 13 mm (3/8 to 1/2 inch) lower than the finish grade.
 2. Scatter aggregate over concrete base surface and embed by use of hand float, straight edge, or darby.
 3. Apply concrete mix and mark off surface as indicated on Drawings with surface joints at least 10 mm (3/8 inch) deep. Level off finish

to a true surface and compact with wood float, working as little as possible so that coarse material will remain at the top. Before finish has set, treat top surface with cement retarding material. When body of concrete finish has set, remove retarded surface film by wire brushes and fine water spray to remove mortar from top of colored aggregate. Continue washing and brushing until flush water runs clear and no noticeable cement film left on the aggregate.

- B. Colored Concrete: Add integral color pigment to the pedestrian concrete paving mix at batch plant. Introduce sufficient quantities of carbon black mineral oxide pigment to produce color specified in Section 09 06 00, SCHEDULE FOR FINISHES.

3.19 CONCRETE CURING

- A. Concrete Protection:
1. Protect unhardened concrete from rain and flowing water.
 2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.
 3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
 - a. Replace pavement damaged by curing method allowing concrete cracking.
 - b. Employ another curing method as directed by Contracting Officer's Representative.
- B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:
1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
 2. Sheet Materials:
 - a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
 - b. Overlap sheets minimum 300 mm (12 inches).
 - c. Securely anchor sheet materials preventing displacement.
 3. Curing Compound:
 - a. Protect joints indicated to receive sealants preventing contamination from curing compound.
 - b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.

- c. Apply curing compound before concrete dries.
- d. Apply curing compound in two coats at right angles to each other.
- e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.
- f. Immediately reapply curing compound to surfaces damaged during curing period.

3.20 CONCRETE PROTECTIVE COATING

- A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.
- B. Complete backfilling and curing operation before applying protective coating.
- C. Dry and thoroughly clean concrete before each application.
- D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.
- E. Protect coated surfaces from vehicular and pedestrian traffic until dry.
- F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.21 FIELD QUALITY CONTROL

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
 - 1. Compaction.
 - a. Pavement subgrade.
 - b. Curb, gutter, and sidewalk.
 - 2. Concrete:
 - a. Delivery samples.
 - b. Field samples.
 - 3. Slip Resistance: Steps and pedestrian paving.

3.22 CLEANING

- A. After completing curing:
 - 1. Remove burlap and sheet curing materials.
 - 2. Sweep concrete clean, removing foreign matter from the joints.
 - 3. Seal joints as specified.

3.23 PROTECTION

- A. Protect exterior improvements from traffic and construction operations.
 - 1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.
 - 1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

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**SECTION 32 17 23
PAVEMENT MARKINGS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Paint and reflective glass beads on pavement surfaces, in form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings.

1.2 RELATED REQUIREMENTS

- A. Paint VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Paint Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. Federal Specifications (Fed. Spec.):
 1. TT-B-1325D - Beads (Glass Spheres) Retro-Reflective.
 2. TT-P-1952F - Paint, Traffic and Airfield Marking, Waterborne.
- C. Master Painters Institute (MPI):
 1. No. 97 - Traffic Marking Paint, Latex.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show pavement marking configuration and dimensions.
 2. Show international symbol of accessibility at designated parking spaces.
- C. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Application instructions.
- D. Samples:
 1. Paint: 200 mm (8 inches) square, each type and color.
- E. Certificates: Certify products comply with specifications.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Regularly installs specified products.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 13 degrees C (55 degrees F) for minimum 48 hours before installation.
 - a. Surface to be painted and ambient temperature: Minimum 10 degrees C (50 degrees F) and maximum 35 degrees C (95 degrees F).
- B. Field Measurements: Verify field conditions affecting traffic marking installation. Show field measurements on Submittal Drawings.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design paint complying with specified performance:
 - 1. Application: Fed. Spec. TT-P-1952.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run.
 - 1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Paints and coatings.

2.3 SANDBLASTING EQUIPMENT

- A. Air compressor, hoses, and nozzles of proper size and capacity as required for cleaning painted surfaces. Compressor to provide minimum 0.08 cu. m/s (150 cfm) of air at pressure of minimum 625 kPa (90 psi) at each nozzle used.

2.4 PAINT APPLICATOR

- A. Apply marking paint with approved mechanical equipment. Provide equipment with constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in case of skip lines. Equipment to have manual control to apply continuous lines of varying length and marking widths as indicated on Drawings. Provide pneumatic spray guns for hand application of paint in areas where mobile paint applicator cannot be used. Use separate piece of equipment when equipment does not have glass bead dispenser. Adjust and synchronize equipment with paint applicator to distribute reflective beads on paint lines uniformly within ten seconds without any waste.

2.5 PAINT

- A. Paint: MPI No. 97. For obliterating existing markings comply with Fed. Spec. TT-P-1952. Provide minimum 18 L (5 gallons) containers.

2.6 REFLECTIVE GLASS BEADS

- A. Beads: Comply with Fed. Spec. TT-B-1325, Type I, Gradation A. In regions of high humidity, coat beads with silicone or other suitable waterproofing material to ensure free flow. Provide glass beads in containers suitable for handling and strong enough to prevent loss during shipment.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Allow new pavement surfaces to cure for period of minimum 14 days before application of marking materials.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or combination of these methods.
2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by Contracting Officer's Representative.
3. As an option, comply with Fed. Spec. TT-P-1952 for removal of existing paint markings on asphalt pavement. Apply black paint in as many coats as necessary to completely obliterate existing markings.
4. Scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application, where oil or grease are present on old pavements to be marked, .
 - a. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through new paint.
5. Clean and dry surface before pavement marking. Do not begin any marking until Contracting Officer's Representative inspected surface and gives permission to proceed.

3.2 TEMPORARY PAVEMENT MARKING

- A. Apply Temporary Pavement Markings of colors, widths and lengths shown on drawings or directed by Contracting Officer's Representative. After temporary marking has served its purpose and when so ordered by Contracting Officer's Representative, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method to prevent damage on applied surface.
- B. As an option, provide approved preformed pressure sensitive, reflective, adhesive tape type of temporary pavement marking of required colors, widths and lengths in lieu of temporary painted and reflective marking. Continuous durability and effectiveness of such marking is required during period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted and reflective markings.

3.3 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.4 PAINT APPLICATION

- A. Apply uniformly painted and reflective pavement marking of required colors, length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces.
- B. Comply with details as indicated on drawings and established control points.
- C. Apply paint at wet film thickness of 0.4 mm (0.015 inch). Disperse reflective glass beads evenly on wet paint at rate of 720 g/L (6 pounds per gal.) of paint. Apply paint in one coat. When directed by Contracting Officer's Representative, apply additional coats at markings showing light spots. Comply with paint manufacturer's maximum drying time requirements to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic.
- D. When deficiency in marking drying occurs, discontinue paint operations until cause of slow drying is determined and corrected.
- E. Remove and replace marking applied less than minimum material rates, deviates from true alignment, exceeds stipulated length and width tolerances, or shows light spots, faulty distribution of beads, smears, or other deficiencies or irregularities.
- F. Remove marking by carefully controlled sandblasting, approved grinding equipment, or other approve method to prevent damage on applied surface.

3.5 DETAIL PAVEMENT MARKING APPLICATION

- A. Apply Detail Pavement Markings, exclusive of actual traffic lane marking as follows:
 1. At exit and entrance islands and turnouts.
 2. On curbs.
 3. At crosswalks.
 4. At parking bays.
 5. Other locations as indicated on drawings.
- B. Apply International Handicapped Symbol at indicated parking spaces. Color as shown on drawings. Apply paint for symbol using suitable template that will provide pavement marking with true, sharp edges and ends.

- C. Install detail pavement markings of colors, widths and lengths, and design pattern at locations indicated on drawings.

3.6 TOLERANCES

- A. Length and Width of Lines: Plus, or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in case of skip markings.
- B. Length of intervals exceeding line length tolerance are not acceptable.

3.7 CLEANING

- A. Remove excess paint before paint sets.

3.8 PROTECTION

- A. Protect pavement markings from traffic and construction operations.
 - 1. Protect newly painted markings from vehicular traffic until paint is dry and track free.
 - 2. Place warning signs at beginning of wet line, and at points well in advance of marking equipment for alerting approaching traffic from both directions.
 - 3. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
- B. Repair damage.

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**SECTION 32 31 40
HIGH SECURITY FENCES AND GATES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. High security fences, gates and accessories.

1.2 RELATED REQUIREMENTS

- A. Temporary Construction Fence: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Concrete Footings: Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 1. A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc Alloy-Coated (Galvannealed) by Hot-Dip Process.
 2. A924/A924M-14e1 - General Requirements for Steel Sheet, Metallic Coated by the Hot-dip Process.
 3. D2794-93(2010) - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 4. F2408-16 - Ornamental Fences Employing Galvanized Steel Tubular Pickets.
- C. Master Painters Institute (MPI):
 1. No. 18 - Primer, Zinc Rich, Organic.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 1. Description of each product.
- D. Certificates: Certify each product complies products comply with specifications.
 1. Fence alignment.
 2. Zinc-coating complies with specifications.
 3. Structural characteristics comply with indicated and criteria on Drawings.
 4. Connections comply with requirements indicated on Drawings.

- E. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Manufacturer with project experience list .
 - 2. Installer with project experience list .
 - 3. Welders and welding procedures.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly manufactures specified products.
 - 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Installer Qualifications: Manufacturer authorized installer.
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- C. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.
AWS D1.3/D1.3M.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoor in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify field conditions affecting high security fence fabrication and installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. System components includes pickets, pales, mesh, fabric, rails, posts, gates and hardware required with following performance requirements:
 - 1. Steel Yield Strength: ASTM A924, minimum 310 MPa (45,000 psi)
344 MPa (50,000 psi) .
 - 2. Impact Resistance: ASTM D2794, over 6.8 Nm (60 in-lb.) when using 0.625 ball forward impact.
- B. Gates: Design to meet same forced entry and anti-climb characteristics as other portions of fence.

2.2 MATERIALS

- A. Zinc-Coated Steel: ASTM A653, G90 coating designation ASTM A924 .
- B. Tubular Steel: ASTM F2408.
- C. Concrete: As specified in Section 03 30 00, Cast-in-Place Concrete.

2.3 PRODUCTS - GENERAL

- A. Provide fence components from one manufacturer.
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.

2.4 HIGH SECURITY FENCE

- A. Pickets: Hot-dip galvanized steel, nominal 68.75 mm (2 3/4 inches) by 18.75 mm (3/4 inch) by 1.98 mm (0.078 inch) thick.
- B. Rails: Hot-dip galvanized steel, nominal 50 mm (2 inch) square.
- C. Gate Posts: Tubular steel, nominal 100 mm (4 inch) square.
 - 1. Provide motorized manually operated sliding gates for vehicle access.
 - 2. Provide hinged pedestrian gates with electric strike and card reader .

2.5 FABRICATION

- A. Fabricate fence and gate to profile and dimensions indicated on Drawings.
- B. Fabricate components with joints tightly fitted and secured.

2.6 FINISHES

- A. Steel Paint Finish:
 - 1. Powder-Coat Finish: Manufacturer's standard two-coat finish system as follows:
 - a. One coat primer.
 - b. One coat thermosetting topcoat.
 - c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
 - d. Color: As selected by Architect.
- B. Finish exposed surfaces after fabrication.

2.7 ACCESSORIES

- A. Accessories: Manufacturer's required accessories for complete installation.
- B. Barrier Coating: ASTM D1187/D1187M.
- C. Welding Materials: AWS D1.1/D1.1M, type to suit application.
- D. Fasteners: Fasteners as recommended by manufacturer.
- E. Gate Hardware: Fence manufacturers standard hardware for motorized manually operated sliding gates.
- F. Galvanizing Repair Paint: MPI No. 18.
- G. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Remove existing fence panels to permit new installation.
 - 1. Retain existing fence panels for reuse.
 - 2. Dispose of other removed materials.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings .
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Excavate for concrete-embedded items.
- C. Set posts in concrete foundation with a minimum depth of 914 mm (36 inches).

- D. Attached fence panel to the line and end posts with manufacturer's standard fasteners.
- E. Install gate to gate posts spaced as indicated on Drawings. Install required hardware and adjust for smooth operation.
- F. Touch up damaged factory finishes.
 - 1. Repair galvanized surfaces with galvanized repair paint.
 - 2. Repair painted surfaces with touch up primer.

3.3 CLEANING

- A. Clean exposed high security fence and gate surfaces. Remove contaminants and stains.

3.4 PROTECTION

- A. Protect high security fences and gates from traffic and construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

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**SECTION 32 90 00
PLANTING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants, soils, edging, turf, and landscape materials.

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

- A. Pesticide: Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and is specifically labeled for use by U.S. Environmental Protection Agency (EPA). Also, any substance used as plant regulator, defoliant, disinfectant, or biocide.
- B. Planter Bed: An area containing one or combination of following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and mulch topdressing excluding turf. Trees may also be found in planter beds.
- C. Stand of Turf: 95 percent of established species.

1.4 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute (ANSI):
1. Z60.1-2014 - Nursery Stock.
- C. American Society for Testing and Materials (ASTM):
1. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 2. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 3. C33/C33M-16-Concrete Aggregates.
 4. C136/C136M-14 - Sieve Analysis of Fine and Coarse Aggregates.
 5. C602-13a - Agricultural Liming Materials.
 6. D977-13e1 - Emulsified Asphalt.
 7. D5268-13 - Topsoil Used for Landscaping Purposes.
- D. Hortus Third: Concise Dictionary of Plants Cultivated in United States and Canada.
- E. Tree Care Industry Association (TCIA):

1. A300P1-2008 - Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance Standard Practices (Pruning).
 2. Z133.1-2012 - Arboricultural Operations - Safety Requirements.
- F. Turfgrass Producers International (TPI):
1. 2006 Guideline Specifications to Turfgrass Sodding.
- G. United States Department of Agriculture (USDA):
1. DOA SSIR 42-2014 - Soil Survey Laboratory Methods Manual.
 2. Handbook No. 60 - Diagnosis and Improvement of Saline and Alkali Soils.

1.5 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Contractor.
 - d. Installer.
 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Inspection of planting materials.
 - b. Installation schedule.
 - c. Installation sequence.
 - d. Preparatory work.
 - e. Protection before, during, and after installation.
 - f. Installation.
 - g. Inspecting.
 - h. Environmental procedures.
 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Description of each product.
 2. Photographs: Color photographs of each plant species showing actual size and condition of plants to be provided with measuring device included for scale. Where more than 20 plants are required of any

species, submit minimum three photographs of average, best, and worst quality plant to be provided. Include on each photograph, plant full scientific name, size, and source nursery.

3. Installation instructions.

4. Warranty.

C. Samples:

1. Trees and Shrubs: Full sized of each variety and size. Deliver samples to project site and maintain samples for duration of construction period.

2. Organic and Compost Mulch: 1 L. (1 quart) sealed plastic bag of each required mulch, including label with percentage weight of each material and source representing material to be provided. Samples to match color, texture, and composition of installed material.

3. Filter Fabric: 300 by 300 mm (12 by 12 inches).

4. Edging Materials and Accessories: Manufacturer's standard sizes.

5. Tree Wrap: Width of panel by 300 mm (12 inches).

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

2. Biobased Content:

a. Show type and quantity for each product.

E. Test reports: Certify products comply with specifications.

F. Certificates: Certify products comply with specifications.

1. Plant Materials: Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease.

2. Seed and Turf Materials: Notarized certificate of product analysis.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Installer, including supervisor with project experience list.

H. Operation and Maintenance Data:

1. Care instructions for each plant material.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations for minimum five years.

- a. Project Experience List: Provide contact names and addresses for completed projects.
3. Member in good standing of either Professional Landcare Network or American Nursery and Landscape Association.
4. Field supervisor certified in one of following categories from Professional Landcare Network and submit one copy of certificate to Contracting Officer's Representative:
 - a. Certified Landscape Technician (CLT) - Exterior, with installation specialty areas, designated CLT-Exterior.
 - b. Certified Landscape Technician (CLT) - Interior, designated CLT-Interior.
 - c. Certified Ornamental Landscape Professional, designated COLP.
- B. Licensed Arborist required to submit one copy of license to Contracting Officer's Representative.
- C. Independent or university laboratory, recognized by State Department of Agriculture, with experience and capability to conduct testing indicated and that specializes in types of tests to be performed.
- D. Measure plants according to ANSI Z60.1. Pruning to obtain required sizes will not be permitted.
- E. Contracting Officer's Representative may review plant materials either at place of growth or project site before planting for compliance with requirements. Contracting Officer's Representative retains right to inspect trees and shrubs to determine if any unacceptable conditions exist and to reject any trees or shrubs at any time during Project. All rejected trees and shrubs must be immediately removed from Project site.
 1. Submit plant material source information to Contracting Officer's Representative seven days in advance of delivery to Project site.
- F. Material Test Reports: For standardized ASTM D5268 topsoil existing native surface topsoil existing in-place surface soil and imported or manufactured topsoil.
 1. For each unamended soil type, provide soil analysis and written report by qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of soil.

2. Comply with USDA's Handbook No. 60 testing methods and written recommendations.
3. Soil-testing laboratory to oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer's Representative. Take minimum 3 representative samples from varied locations for each soil to be used or amended for planting purposes.
4. Report suitability of tested soil for plant growth.
5. Based on test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 92.9 sq. m (1000 sq. ft.) or volume per 0.76 cu. m (1 cu. yd.) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
6. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.8 DELIVERY

- A. Deliver packaged products in manufacturer's original sealed packaging.
- B. Bulk Products:
 1. Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.
 2. Install erosion control materials to prevent erosion or displacement of bulk products.
- C. Apply antidesiccant to trees and shrubs according to manufacturer's instructions to protect during digging, handling, and transportation.
 1. For deciduous trees or shrubs in full leaf, spray with antidesiccant at nursery before transporting and again two weeks after planting.
- D. Wrap trees and shrubs with tree wrap according to manufacturer's instructions to protect from wind and other damage during digging, handling, and transportation.
- E. Deliver bare-root stock plants freshly dug with root system packed in wet straw, hay, or similar material.

- F. Deliver branched plants with branches tied and exposed branches covered with material that allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.
- G. Use of equipment such as "tree spades" is permitted provided plant balls are sized according to ANSI Z60.1 and tops are protected from damage.

1.9 STORAGE AND HANDLING

- A. Store bulbs, corms, and tubers in dry location at 16 to 18 degrees C (60 to 65 degrees F) until planting.
- B. Store seeds and other packaged materials in dry locations away from contaminants.
- C. Plant Storage and Protection: Store and protect plants not planted on day of arrival at Project site as follows:
 - 1. Shade and protect plants in outdoor storage areas from wind and direct sunlight until planted.
 - 2. Heel-in bare root plants.
 - 3. Protect balled and burlapped plants from freezing or drying out by covering balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering that allows air circulation.
 - 4. Keep plants in moist condition until planted by watering with fine mist spray.
 - 5. Do not store plant materials directly on concrete or bituminous surfaces.
- D. Topsoil: Before stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks before stockpiling existing topsoil.
- E. Root Control Barrier and Weed Control Fabric: Store materials in site in enclosures or under protective covering in dry location out of direct sunlight. Do not store materials directly on ground.
- F. Handling: Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped plants carefully to avoid damaging or breaking earth ball or root structure. Do not handle plants by trunk or stem. Remove damaged plants from Project site.

1.10 FIELD CONDITIONS

- A. Environment:

1. Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.
 2. Planting Dates: per recommendation of landscape contractor.
 3. Restrictions: Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceed 32 degrees C (90 degrees F).
- B. Weather Limitations: Install plantings only during current and forecasted weather conditions that are comply with plant requirements. Apply associated products in compliance with manufacturers' instructions.

1.11 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Provide each product from one source or manufacturer.
- B. Sustainable Construction Requirements:
1. Select products with recycled content to achieve overall Project recycled content requirement.
 - a. Fertilizer.
 - b. Weed control fabric.
 - c. Root control barrier.
 2. Steel Recycled Content: 30 percent total recycled content, minimum.
 3. Aluminum Recycled Content: 80 percent total recycled content, minimum.
 4. Biobased Content:
 - a. Organic Mulch: 100 percent.
 - b. Peat: 100 percent.

2.2 PLANT MATERIALS

- A. Plant Materials: ANSI Z60.1, conforming to varieties specified and be true to scientific name as listed in Hortus Third. Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having healthy, normal, and undamaged root system.
1. Trees-Deciduous and Evergreen: Single trunked with single leader, unless otherwise indicated; symmetrically developed deciduous trees

and shrubs of uniform habit of growth; straight boles or stems; free from objectionable disfigurements; evergreen trees and shrubs with well-developed symmetrical tops, with typical spread of branches for each particular species or variety. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk; crossing trunks; cut-off limbs more than 19 mm (3/4 inch) in diameter; or with stem girdling roots will be rejected.

2. Provide plants of sizes indicated, measured before pruning with branches in normal position. Plants larger in size than specified is acceptable with approval of Contracting Officer's Representative, with no change in contract price. When larger plants are used, increase ball of earth or spread of roots according to ANSI Z60.1.
 3. Provide nursery grown plant material conforming to requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in manner that will not cause damage to branches, shape, and future development after planting.
 4. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.
 5. Bare root (BR) plants to have root system substantially intact, but with earth carefully removed. Cover roots with thick coating of mud by "puddling" after plants are dug.
 6. Container grown plants to have sufficient root growth to hold earth intact when removed from containers, but not be root bound.
 7. Make substitutions only when plant (or alternates as specified) is not obtainable and Contracting Officer's Representative authorizes change order providing for use of nearest equivalent obtainable size or variety of plant with same essential characteristics and an equitable adjustment of contract price.
 8. Existing plants to be relocated: Ball sizes to conform to requirements for collected plants in ANSI Z60.1, and plants dug, handled, and replanted according to applicable articles of this Section.
 9. Only plants grown in nursery are permitted.
- B. Label plants with durable, waterproof labels in weather-resistant ink. Provide labels stating correct botanical and common plant name and

variety and size as specified in list of required plants. Groups of plants may be labeled by tagging one plant. Labels to be legible for minimum 60 days after delivery to planting site.

2.3 SOD

- A. Sod: Nursery grown, certified and classified in TPI's "Guideline Specifications to Turfgrass Sodding" as GSS. Machine cut sod at uniform thickness of 19 mm (3/4 inch) within tolerance of 6 mm (1/4 inch), excluding top growth and thatch. Each individual sod piece to be strong enough to support its own weight when lifted by ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will not be permitted.
- B. Sod Species: Genetically pure, free of weeds, pests, and disease. Sod species to match existing species on site and as recommended by landscape contractor.

2.4 SEED

- A. Grass Seed: State-approved and to match existing species on site and as recommended by landscape contractor.

2.5 TURF SELECTIONS

- A. Grasses for Warm Regions:
 - 1. Bermuda grass (*Cynodon dactylon*).
 - 2. Carpetgrass (*Axonopus affinis*).
 - 3. Centipedegrass (*Eremochloaophioides*).
 - 4. St. Augustinegrass (*Stenotaphrum secundatum*).
 - 5. Zoysiagrass (*Zoysia matrella*).

2.6 PLANTING SOILS

- A. Planting Soil: Evaluate soil for use as topsoil according to ASTM D5268. From 5 to 10 percent organic matter as determined by topsoil composition tests of Organic Carbon, 6A, Chemical Analysis Method described in USDA DOA SSIR 42. Maximum particle size, 19 mm (3/4 inch), with maximum 3 percent retained on 6 mm (1/4 inch) screen. Mix topsoil with following soil amendments and fertilizers as recommended by soils analysis.
- B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable

planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with another specified planting soil when quantities are insufficient.
 2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by soils analysis.
- C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources are acceptable if sufficient topsoil is not available on site to meet specified depth. At least 10 days before topsoil delivery, notify Contracting Officer's Representative of topsoil sources. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil is at least 100 mm (4 inches) deep. Topsoil from agricultural land, bogs, or marshes will be rejected.

2.7 INORGANIC SOIL AMENDMENTS

- A. Lime: Commercial grade burnt limestone containing calcium carbonate equivalent (CCE) specified in ASTM C602 of minimum 80 percent.
- B. Sulfur: 100 percent elemental.
- C. Iron Sulfate: 100 percent elemental.
- D. Aluminum Sulfate: Commercial grade.
- E. Perlite: Horticultural grade.
- F. Agricultural Gypsum: Coarsely ground from recycled scrap gypsum board comprised of calcium sulfate dehydrate 91 percent, calcium 22 percent, sulfur 17 percent, minimum 96 percent passing through 850 micrometers 20 mesh screen, 100 percent passing through 970 micrometers 16 mesh screen.
- G. Coarse Sand: ASTM C33/C33M, clean and free of materials harmful to plants.
- H. Vermiculite: Horticultural grade for planters.
- I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.8 ORGANIC SOIL AMENDMENTS

- A. Organic Matter: Commercially prepared compost. Free of substances toxic to plantings and as follows:

1. Organic Matter Content: Wood cellulose fiber, wood chips, ground or shredded bark, shredded hardwood, bark peelings, pine straw mulch, pine needles from project site when available. Biobased content 100 percent. Wood cellulose fiber processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to appropriate color to facilitate visual metering of materials application.
 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Natural product of peat moss derived from fresh-water site, conforming to ASTM D4427 and containing no invasive species, including seeds. Shred and granulate peat to pass 12.5 mm (1/2 inch) mesh screen and condition in storage pile for minimum 6 months after excavation. Biobased content minimum 100 percent.
- C. Composted Derivatives: Ground bark, nitolized sawdust, humus, or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having following properties:
1. Particle Size: Minimum percent by weight passing:
 - a. 4.75 mm (No. 4) mesh screen: 95.
 - b. 2.36 mm (No. 8) mesh screen: 80.
 2. Nitrogen Content: Minimum percent based on dry weight:
 - a. Fir sawdust: 0.7.
 - b. Fir or pine bark: 1.0.
 3. Biobased Content: 100 percent.
- D. Manure: Well-rotted, horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks, soil, and other invasive species.

2.9 PLANT FERTILIZERS

- A. Soil Test: Evaluate existing soil conditions and requirements before fertilizer selection and application to minimize use of all fertilizers and chemical products. Obtain approval of Contracting Officer's Representative for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and

warranty requirements. Fertilizers to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial grade plant and turf fertilizers, free flowing, uniform in composition and conforms to applicable state and federal regulations.

- B. Fertilizer for groundcover, wildflowers, and grasses is not acceptable. Provide fertilizer for trees, plants, and shrubs as recommended by plant supplier, except synthetic chemical fertilizers are not acceptable. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not acceptable.
- C. Granular Fertilizer: Organic, granular controlled release fertilizer containing minimum percentages, by weight, of plant food nutrients.
 - 1. Composition: Nitrogen, phosphorous, potassium, sulfur, and iron in amounts recommended in soil reports from qualified soil-testing laboratory.
- D. Fertilizer Tablets: Organic plant tablets composed of tightly compressed fertilizer chips, insoluble in water, to provide continuous release of nutrients for minimum 24 months and containing following minimum percentages, by weight, of plant food nutrients:
 - 1. Nutrient Composition: 20 percent available nitrogen, 20 percent available phosphorous, and 5 percent available potassium.

2.10 WEED CONTROL FABRIC

- A. Roll Type Polypropylene or Polyester Mats: Woven, needle punched, or non-woven fabric treated for protection against deterioration due to ultraviolet radiation. Minimum 99 percent opaque to prevent photosynthesis and seed germination, fabric allows air, water, and nutrients to pass through to plant roots.
 - 1. Minimum weight: 0.11 kg per square meter (5 ounces per square yard).
 - 2. Minimum thickness: 0.50 mm (20 mils).

2.11 MULCH

- A. Organic Mulch:
 - 1. Ground or shredded bark, shredded hardwood, bark peelings, pine straw mulch, pine needles for project site when available. Biobased content minimum 100 percent. Wood cellulose fiber processed to contain no growth or germination-inhibiting factors, dyed with

non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of application.

- a. Straw for Lawn Seed Bed Mulch: Stalks from oats, wheat, rye, barley, or rice free of noxious weeds, mold or other objectionable material. Air dried and suitable for placing with blower equipment.
2. Color: Natural.
- B. Compost Mulch: Decomposed organic matter with low carbon to nitrogen ratio.
- C. Mineral Mulch: Coarse, clean stone of following type, size, and color:
 1. Type: pea gravel.
 2. Size: ASTM C136/C136M, 65 mm (2-1/2 inches) maximum and 25 mm (1 inch) minimum.
 3. Color: Acceptable to Contracting Officer's Representative.

2.12 EDGING

- A. Steel Edging: Commercial-grade steel product with rolled edge, in standard lengths, with steel loops for installation with stakes.
 1. Edging Size: 4.8 mm (3/16 inch) wide by 100 mm (4 inches).
 2. Stakes: Steel to match edging, tapered, minimum // 300 mm (12 inches) long.
 3. Accessories: End pieces, end stakes, corner stakes, and splicing stakes.
 4. Finish: Painted.
 5. Paint Color: Brown.
- B. Aluminum Edging: ASTM B221M (ASTM B221), manufactured from extruded aluminum alloy 6063-T6, in interlocking sections with punch-outs fabricated in each section for installation with stakes.
 1. Edging Size: 4.8 mm (3/16 inch) wide by 140 mm (5-1/2 inches) deep.
 2. Stakes: Aluminum to match edging, minimum 300 mm (12 inches) long by 38 mm (1-1/2 inches) wide.
 3. Finish: Paint.
 4. Paint Color: Brown.
- C. Natural Cut Edging: Edge plant beds with an excavated 'V' cut to provide clear division between plant bed and adjacent turf. Artificial or manufactured products to form plant bed edges will not be permitted.

2.13 ANTIDESICCANT

- A. Antidesiccant: An emulsion specifically manufactured for agricultural use that will provide protective film over plant surfaces permeable enough to permit transpiration.

2.14 EROSION CONTROL

- A. Erosion Control Fabric: Knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm (3/4 to 1 inch) square with strips of biodegradable paper. Minimum filler paper strip life of six months.

2.15 ROOT CONTROL BARRIER

- A. Root Control Barrier: Flexible and permeable geotextile fabric with permanently attached time-release nodules. Pre-formed barrier with integral vertical root deflecting ribs constructed of ultraviolet resistant polypropylene material.

2.16 BIOSTIMULANTS

- A. Biostimulants: Formulation containing soil conditioners, VAM fungi, and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions.

2.17 STAKING AND GUYING MATERIALS

- A. Staking Material:
 - 1. Tree Support Stakes: Rough sawn hardwood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Minimum 50 mm (2 inches) square by 2.4 m (8 feet) long, pointed at one end.
 - 2. Ground Stakes: 50 mm (2 inches) square by 0.91 m (3 feet) long wood or plastic, pointed at one end.
- B. Guying Material:
 - 1. Guying Wire: ASTM A580/A580M, galvanized steel wire.
 - 2. Guying Cable: Minimum five-strand, 5 mm (3/16 inch) galvanized steel cable.
- C. Hose Chafing Guards: New or used 2 ply 19 mm (3/4 inch) reinforced rubber or plastic hose, black or dark green, all of same color.
- D. Flags: White surveyor's plastic tape 150 mm (6 inches) long, fastened to guying wires or cables.
- E. Turnbuckles: Galvanized or cadmium-plated steel with minimum 75 mm (3 inch) long openings fitted with screw eyes and galvanized or

cadmium-plated steel eye bolts with 25 mm (1 inch) diameter eyes and 38 mm (1-1/2 inches) minimum screw length.

2.18 TREE WRAP

- A. Crinkled Paper Tree Wrap: Two thicknesses of crinkled paper cemented together with layer of bituminous material. Minimum 100 mm (4 inches) wide with stretch factor of 33 1/3 percent. Tie with lightly tarred medium or coarse sisal yarn twine.
- B. Tree Shelters: Extruded, translucent, twin walled polypropylene protection board sheets, 3 mm (1/8 inch) thick, 1800 mm (6 feet) long, utilized for short trunk trees 75 mm (3 inch) caliper or less.
- C. Synthetic Fabric Tree Wrap: White, breathable polypropylene fabric in 75 mm (3 inch) wide rolls.
- D. Tape: Bio-degradable tape suitable for nursery use to secure tree wrap which degrades in sunlight maximum 2 years after installation.

2.19 TACKIFIERS AND ADHESIVES

- A. Nonasphalt Tackifier: Colloidal liquid fixative recommended by fiber mulch manufacturer for hydroseeding.
- B. Asphalt emulsion: ASTM D977, Grade SS-1.

2.20 WATER

- A. Water: Source approved by Contracting Officer's Representative and suitable quality for irrigation, containing no elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

2.21 PESTICIDES

- A. Consider IPM (Integrated Pest Management) practices to minimize use of all pesticides and chemical products. Obtain Contracting Officer's Representative's approval for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and warranty requirements.

2.22 FINISHES

- A. Steel Paint Finish:
 - 1. Powder-Coat Finish: Manufacturer's standard two-coat finish system consisting of following:

- a. One coat primer.
 - b. One coat thermosetting topcoat.
 - c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
 - d. Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Aluminum Anodized Finish: NAAMM AMP 500.
1. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
1. Verify that no materials that would inhibit plant growth are present in planting area. If such materials are present, remove soil and contaminants as directed by Contracting Officer's Representative and provide new planting soil.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling operations if soil moisture becomes excessive. Resume soil preparations when moisture content returns to acceptable level.
 4. If soil is excessively dry, not workable, and too dusty, moisten uniformly.
 5. Special conditions may exist that warrant variance in specified planting dates or conditions. Submit written request to Contracting Officer's Representative stating special conditions and proposed variance.
- B. Proceed with planting operations only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect existing and proposed landscape features, elements, and site construction and completed work from damage. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on drawings.

- B. Install erosion control materials at all areas inside or outside limits of construction that are disturbed by planting operations. Provide erosion control and seeding with native plant species to protect slopes.
- C. Stake out approved plant material locations and planter bed outlines on project site before digging plant pits or beds. Contracting Officer's Representative reserves right to adjust plant material locations to meet field conditions. Do not plant closer than 300 mm (12 inches) to building wall pavement edge, fence or wall edge, and other similar structures. Provide on-site locations for excavated rock, soil, and vegetation.

3.3 PLANT BED PREPARATION

- A. Verify location of underground utilities before excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to depth that will ensure removal of entire roof system. Measure depth of plant pits from finished grade. Provide depth of plant pit excavation and relation of top of root ball and finish grade as indicated on drawings. Install plant materials as specified in Article 3.8. Do not plant trees within 3 m (10 feet) of any utility lines or building walls.
- B. For newly graded subgrades, loosen subgrade to minimum 150 mm (6 inches) deep. Remove stones larger than 25 mm (1 inch) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
 - 1. Apply fertilizer, lime, and soil amendments directly to subgrade before loosening, at rates recommended by soils analysis.
 - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 3. Spread planting soil 150 mm (6 inches) deep but minimum required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 thickness of planting soil over loosened subgrade. Mix thoroughly into top 100 mm (4 inches) of subgrade. Spread remainder of planting soil.

- b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Finish grade planting areas to smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 13 mm (1/2 inch) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in immediate future.

3.4 GROUND COVER AND PLANT INSTALLATION

- A. Place ground cover and plants in spacing recommended by contractor and as indicated on drawings in even rows and with triangular spacing.
- B. Use prepared soil mixture for backfill.
- C. Place so roots are in natural position.
- D. Do not remove plants from flats or containers until immediately before planting. Plant at depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Water plants at sufficient rate to ensure thorough wetting of soil to 150 mm (6 inches) deep without runoff or puddling. Smooth planting areas after planting to provide even, smooth finish.
- E. Plant ground cover in areas to receive erosion control materials through material after erosion control materials are in place.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Move plant materials only by supporting root ball. Set plants on hand compacted layer of prepared backfill soil mixture 150 mm (6 inches) thick and hold plumb in center of pit until soil has been tamped firmly around root ball.
- B. Set plant materials in relation to surrounding finish grade 25 to 50 mm (1 to 2 inches) above depth at which they were grown in nursery, collecting field, or container. Replace plant material whose root balls are cracked or damaged either before or during planting process.
- C. Place backfill soil mixture on previously scarified subsoil to completely surround root balls and bring to smooth and even surface, blending into existing areas.
- D. Balled and Burlapped Stock: Backfill with prepared soil mixture to approximately half ball depth then tamp and water. Carefully remove or fold back excess burlap and tying materials from top to minimum 1/3 depth from top of root ball. Tamp and complete backfill, place mulch

topdressing, and water. Remove wires and non-biodegradable materials from plant pit before backfilling.

3.6 MECHANIZED TREE SPADE PLANTING

- A. At designated locations and with approved equipment, trees may be planted by mechanized tree spade. Tree spade is not acceptable for moving trees that are larger than maximum size of similar field-grown, balled-and-burlapped root-ball diameter recommended by ANSI Z60.1, or that are larger than manufacturer's recommended maximum size for tree spade to be used, whichever is smaller.
- B. For tree extraction, center trunk in tree spade and move tree and solid root ball.
- C. Cut any exposed roots with sharp instruments.
- D. Excavate planting hole with same tree spade used to extract and move tree.
- E. If possible, place trees with same orientation as at location from which they were extracted.

3.7 TREE WRAP

- A. Wrap deciduous tree trunks immediately after planting. Wrap tree trunks 40 mm (1-1/2 inches) or greater in caliper with specified material beginning at base and extending to lowest branches. Remove tree wrap after one year. Securely tie crinkled paper wrap with twine at top and bottom and at maximum 450 mm (18 inch) intervals.

3.8 TREE AND SHRUB PRUNING

- A. Pruning: Performed by trained and experience personnel according to TCIA A300P1.
- B. Remove dead and broken branches. Prune only to correct structural defects.
- C. Retain typical growth shape of individual plants with as much height and spread as practical. Do not central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars to remain in place.
- D. Do not apply tree wound dressing to cuts.

3.9 STAKING AND GUYING

- A. Staking: Stake plants with number of stakes indicated on drawings with double strand of guy wire. Attach guy wire at half tree trunk height but maximum 1.5 m (5 feet) high. Drive stakes to depth of 0.80 to

0.91 m (2-1/2 to 3 feet) into the ground outside plant pit. Do not injure root ball. Install hose chaffer guards where wire is in contact with tree trunk.

- B. Guying: Guy plants as indicated on drawings and as recommended by landscape contractor

3.10 ROOT CONTROL BARRIER INSTALLATION

- A. At trees planted within 1500 mm (60 inches) of paving, walls, curbs, and walkways, install root control barrier, unless otherwise shown on Drawings.
- B. Install geotextile fabric in soil for vertical and horizontal application with appropriate holding device to ensure fabric position. For vertical and horizontal application, provide minimum 50 mm (2 inch) soil cover over top surface. Extend fabric minimum 450 mm (18 inches) beyond structure area to be protected to prevent root growth around fabric edges.
- C. Install polypropylene barrier minimum 25 mm (1 inch) above finished grade to prevent root growth over barrier. Backfill outside barrier with 19 to 25 mm (3/4 to 1 inch) of gravel for minimum 50 mm (2 inches). For linear application, use device recommended by barrier manufacturer to connect two pieces.

3.11 MULCH INSTALLATION

- A. Provide specified mulch over entire planting bed surfaces and individual plant surfaces, including earth mount watering basin around plants, to 75 mm (3 inches) depth after plant installation and before watering. Do not place mulch in crowns of shrubs. Place mulch minimum 50 to 75 mm (2 to 3 inches) away from tree or shrub trunks. Place mulch on all weed control fabric.

3.12 EDGING INSTALLATION

- A. Uniformly edge beds of plants to provide clear cut division line between planted area and adjacent lawn. Construct bed shapes as indicated on drawings.
- B. Metal Edging: Install steel or aluminum edging material according to manufacturer's instructions. Install edging material in perfect 1.22 m (4 foot) diameter circle inside 1.37 m (4-1/2 foot) watering basin, around specimen trees and shrubs not planted in close group. Install edging with minimum 25 mm (1 inch) visible above ground level.

- C. Natural Cut Edging: Provide uniform 'V' cut with one vertical side adjacent to turf areas 125 mm (5 inches) deep and second side angled 250 mm (10 inches) toward center of plant bed for clear cut division line between plant bed and adjacent lawn.

3.13 SODDING

- A. Place sod maximum 36 hours after initial harvesting according to TPI GSS, except as modified herein.
- B. For slopes 2 to 1 and greater, lay sod with long edge perpendicular to contour. For V-ditches and flat-bottomed ditches, lay sod with long edge perpendicular to water flow. Anchor each piece of sod with wood pegs or wire staples maximum 600 mm (24 inches) on center. On sloped areas, start sodding at bottom of slope.
- C. Finishing: After sodding, blend edges of sodded area smoothly into surrounding area. Eliminate air pockets and provide true and even surface. Trim frayed areas and patch holes and missing areas with sod.
- D. Rolling: Immediately after sodding, firm entire area, except slopes in excess of 3: 1, with roller maximum 134 kg (90 lbs.) for each foot of roller width.
- E. Watering: Start watering sodded areas as required by daily temperature and wind conditions. Water at rate sufficient to ensure thorough wetting of soil to minimum 150 mm (6 inches) deep. Prevent run-off, puddling, and wilting. Do not drive watering trucks over turf areas, unless otherwise directed. Prevent watering of other adjacent areas or plant materials.

3.14 SPRIGGING

- A. Plant sod sprigs after finish grade is properly prepared and thoroughly soaked day in advance. Plant sprigs in rows spaced maximum 300 mm (12 inches) apart with springs placed in rows at maximum 150 mm (6 inches) apart. Firm entire area with roller not exceeding 130 kg/m (90 lb./ft.) of roller width. Do not roll slopes over maximum 3: 1. Water thoroughly and keep soil moist. Weed by hand or hoe. Do not treat sprig area with herbicide.

3.15 PLUGGING

- A. Plant fresh sod plugs after finish grade is properly prepared. Plant plugs in rows, spaced 300 mm (12 inches) 450 mm (18 inches) apart in both directions. On slopes, contour rows to near level. Water

thoroughly and keep soil moist. Weed by hand or hoe. Do not treat plug area with herbicide.

3.16 SEEDING

- A. Broadcast and Drop Seeding: Uniformly broadcast seed at rate as recommended by landscape contractor. Use broadcast or drop seeders. Sow one-half seed in one direction and sow remainder at right angles to first sowing. Cover seed uniformly to maximum 6 mm (1/4 inch) deep in clay soils and 13 mm (1/2 inch) deep in sandy soils by means of spike-tooth harrow, cultipacker, raking, or other approved device.
- B. Rolling: Immediately after seeding, firm entire area, except for slopes in excess of 3 to 1, with roller not exceeding 130 kg/m (90 lb./ft.) of roller width. Eliminate rolling if seeding is done with cultipacker type seeder.

3.17 PLANT MAINTENANCE

- A. Frequency: Begin maintenance immediately after plants have been installed. Inspect plants at least once week and perform required maintenance promptly.
- B. Promotion of Plant Growth and Vigor: Water, prune, fertilize, mulch, eradicate weeds, and perform other operations necessary to promote plant growth and vigor.
- C. Planter Beds: Weed, fertilize, and irrigate planter beds and keep pest free, pruned, and mulch levels maintained. Do not permit planter beds encroach into turf areas. Maintain edging breaks between turf areas and planter beds. Fertilize plant materials to promote healthy growth without encouraging excessive top foliar growth. Remove noxious weeds common to area from planter beds by mechanical means.
- D. Shrubs: In addition to planter bed maintenance requirements, selectively prune and shape shrubs for health and safety when following conditions exist:
 - 1. Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel.
 - 2. Remove dead, damaged, or diseased branches or limbs where shrub growth obstructs pedestrian walkways, where shrub growth is growing against or over structures, and where shrub growth permits concealment of unauthorized persons.
 - 3. Properly dispose of all pruning debris.

E. Trees: Adjust stakes, ties, guy supports and turnbuckles and water, fertilize, control pests, mulch, and prune for health and safety and provide fall leaf cleanup.

1. Fertilize trees to promote healthy plant growth without encouraging excessive top foliar growth. Inspect and adjust stakes, ties, guy supports and turnbuckles to avoid girdling and promote natural development.
2. Selectively prune all trees within project boundaries, regardless of caliper, for safety and health reasons, including, but not limited to, removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced.
3. All pruning, including palm tree pruning, must be by or in presence of certified member of International Society of Arboriculture and according to TCIA Z133.1.
4. Properly dispose of all pruning debris.

3.18 SLOPE EROSION CONTROL MAINTENANCE

A. Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped and natural growth areas. Maintenance tasks include immediate repairs to weak spots in sloped areas and maintaining clean, clear culverts and graded berms and terraces to intercept and direct water flow to prevent development of large gullies and slope erosion and securing irrigation systems during periods of extended rainfall.

1. Fill eroded areas with amended topsoil and replant with same plant species.
2. Reinstall erosion control materials damaged due to slope erosion.

3.19 REMOVAL OF DYING OR DEAD PLANTS

A. Remove dead and dying plants and provide new plants immediately upon commencement of specified planting season and replace stakes, guys, mulch, and eroded earth mound water basins. No additional correction period will be required for replacement plants beyond original warranty period. Plants will be considered dead or dying as follows:

1. Tree: Main leader died back, or minimum 20 percent of crown died.
2. Shrub and Ground Cover: Minimum 20 percent of plant died.

3. Determination: Scrape on maximum 2 mm (1/16 inch) square branch area to determine dying plant material cause and provide recommendations for replacement.

3.20 TURF MAINTENANCE

- A. Mow turf to uniform finished height measured from soil. Perform mowing in manner that prevents scalping, rutting, bruising, uneven and rough cutting. Before mowing, remove and dispose of all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on turf areas. Sweep or vacuum clean adjacent paved areas.
- B. Apply fertilizer in manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. Determine method of application, fertilizer type and frequencies by results of laboratory soil analysis. Provide organic fertilizer. If organic fertilizer does not produce desired effect, contact Contracting Officer's Representative for approval before applying synthetic fertilizer. Apply fertilizer by approved methods and according to manufacturer's instructions.
- C. Watering: Perform irrigation in manner that promotes health, growth, color, and appearance of cultivated vegetation, complying with Federal, State, and local water agency and authority directives. Prevent overwatering, water run-off, erosion, and ponding due to excessive quantities or rate of application.
- D. Aeration: Eradicate weeds and, with Contracting Officer's Representative's approval to proceed, aerate turf areas with approved device.

3.21 CLEANING

- A. Remove and legally dispose of all excess soil and planting debris.

3.22 PROTECTION

- A. Protect plants from traffic and construction operations.
- B. Provide temporary fences or enclosures and signage, at planted areas. Maintain fences and enclosures during maintenance period.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

- - - E N D - - -

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and procedures for construction of underground water distribution for domestic and/or fire supply systems outside the building that are complete and ready for operation. This includes piping, structures, appurtenances and all other incidentals.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete: Section 03 30 00, CAST IN-PLACE CONCRETE.
- C. Fire Protection System connection: Section 21 12 00, FIRE-SUPPRESSION STANDPIPES.
- D. General plumbing: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- F. Metering: Section 25 10 10, ADVANCED UTILITY METERING SYSTEM.
- G. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

- A. Water distribution system: Pipelines and appurtenances which are part of the distribution system outside the building for potable water and fire supply.
- B. Water service line: Pipeline from main line to 5 feet outside of building.

1.4 ABBREVIATIONS

- A. PVC: Polyvinyl chloride plastic.
- B. DI: Ductile iron pipe.
- C. WOG: Water, Oil and Gas.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends and flange faces.

- B. Use a sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- D. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.
- E. Store plastic piping protected from direct sunlight and support to prevent sagging and bending.
- F. Cleanliness of Piping and Equipment Systems:
 - 1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
 - 2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

1.6 COORDINATION

- A. Coordinate connection to water main with Public Utility company.
- B. Coordinate water service lines with building contractor.

1.7 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. Digital electronic devices, software and systems such as controls, instruments or computer workstations shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.

C. Regulatory requirements:

1. Comply with the rules and regulations of the public utility company having jurisdiction over the connection to public water lines and the extension and/or modifications to public utility systems.
2. Comply with the rules and regulations of the Federal, State and/or Local Health Department of Environmental Quality having jurisdiction for potable water-service.
3. Comply with rules and regulations of Federal, State, and/or Local authorities having jurisdiction for fire-suppression water-service piping including materials, hose threads, installation and testing.

D. Provide certification of factory hydrostatic testing of not less than 500 psi (3.5 MPa) in accordance with AWWA C151. Piping materials shall bear the label, stamp or other markings of the specified testing agency.

E. Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the American Welding Society.

F. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation.

G. Applicable codes:

1. Plumbing Systems: IPC, International Plumbing Code.
2. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

3. Fire-service main products shall be listed in the FM Global
"Approval Guide" or Underwriters Laboratories (UL) "Fire Protection
Equipment Directory".

1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
- MSS SP-60-2004 Connecting Flange Joint Between Tapping Sleeves
and Tapping Valves
- MSS SP-108-2002.....Resilient-Seated Cast Iron, Eccentric Plug
Valves
- MSS SP-123-1998 (R2006) ..Non-Ferrous Threaded and Solder-Joint Unions
for Use with Copper Water Tube
- C. American Society of Mechanical Engineers (ASME):
- A112.1.2-2004.....Air Gaps in Plumbing Systems (for Plumbing
Fixtures and Water-Connected Receptors))
- A112.6.3-2001.....Floor Drains
- B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings,
Class 25, 125, 250
- B16.18-2001.....Cast Copper Alloy Solder Joint Pressure
Fittings
- B16.22-2001.....Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
- B16.24-2006.....Cast Copper Alloy Pipe Flanges and Flanged
Fittings; Classes 150, 300, 600, 900, 1500 and
2500
- B31.....Code for Pressure Piping Standards
- D. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Carbon Structural Steel
- A48/A48M-08 (2008) Gray Iron Castings
- A536-84 (2009) Ductile Iron Castings
- A674-10.....Polyethylene Encasement for Ductile Iron Pipe
for Water or Other Liquids
- B61-08.....Steam or Valve Bronze Castings
- B62-09.....Composition Bronze or Ounce Metal Castings

B88/B88M-09.....	Seamless Copper Water Tube
C651-05.....	Disinfecting Water Mains
C858-10e1.....	Underground Precast Utility Structures
D1785-06.....	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D2239-03.....	Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
D2464-06.....	Threaded Poly (Vinyl Chloride) PVC Pipe Fittings, Schedule 80
D2466-06.....	Poly (Vinyl Chloride) (PVC) Pipe Fittings, Schedule 40
D2467-06.....	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D2609-02 (2008).....	Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
D3350-10a.....	Polyethylene Plastics Pipe and Fittings Materials
F714-10.....	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
F1267-07.....	Metal, Expanded, Steel
American Water Works Association (AWWA):	
B300-10.....	Hypochlorites
B301-10.....	Liquid Chlorine
C104-08.....	Cement-Mortar Lining for Ductile Iron Pipe and Fittings
C105/A21.5-10.....	Polyethylene Encasement for Ductile Iron Pipe Systems
C110-08.....	Ductile Iron and Gray-Iron Fittings
C111/A21.11-07.....	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
C115/A21.11-11.....	Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges
C151/A21.51-09.....	Ductile Iron Pipe, Centrifugally Cast
C153/A21.53-11.....	Ductile Iron Compact Fittings for Water Service
C502-05.....	Dry-Barrel Fire Hydrants
C503-05.....	Wet-Barrel Fire Hydrants

- C504-10.....Rubber-Seated Butterfly Valves
- C508-09.....Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS
- C509-09.....Resilient-Seated Gate Valves for Water Supply Service
- C510-07.....Double Check Valve Backflow Prevention Assembly
- C511-07.....Reduced-Pressure Principle Backflow Prevention Assembly
- C512-07.....Air Release, Air/Vacuum and Combination Air Valves
- C550-05.....Protective Interior Coatings for Valves and Hydrants
- C600-10.....Installation of Ductile Iron Mains and Their Appurtenances
- C605-11.....Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- C606-11.....Grooved and Shouldered Joints
- C651-05.....Disinfecting Water Mains
- C700-09.....Cold-Water Meters, "Displacement Type," Bronze Main Case
- C800-05.....Underground Service Line Valves and Fittings
- C900-09.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- C906-07.....Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 64 In. (1,600 mm), for Water Distribution and Transmission
- C907-04.....Injection-Molded PVC Pressure Fittings, 4 Inch through 12 Inch (100 mm through 300 mm), for Water Distribution
- M23-2nd Ed.....PVC Pipe, Design and Installation
- M44-2nd Ed.....Distribution Valves: Selection, Installation, Field Testing and Maintenance

F. National Fire Protection Association (NFPA):

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NFPA 24-2010 Ed.....Installation of Private Fire Service Mains and
Their Appurtenances

NFPA 1963-2009 Ed.....Fire Hose Connections

G. NSF International (NSF):

NSF/ANSI 14 (2013).....Plastics Piping System Components and Related
Materials

NSF/ANSI 61-2012.....Drinking Water System Components - Health
Effects

NSF/ANSI 372-2011.....Drinking Water System Components - Lead Content

H. American Welding Society (AWS):

A5.8/A5.8M-2004 Filler Metals for Brazing and Braze Welding

I. American Society of Safety Engineers (ASSE):

1003-2009 Water Pressure Reducing Valves

1015-2009.....Double Check Backflow Prevention Assemblies and
Double Check Fire Protection Backflow
Prevention Assemblies

1020-2004.....Pressure Vacuum Breaker Assembly

1047-2009.....Performance Requirements for Reduced Pressure
Detector Fire Protection Backflow Prevention
Assemblies

1048-2009.....Performance Requirements for Double Check
Detector Fire Protection Backflow Prevention
Assemblies

1060-2006.....Performance Requirements for Outdoor Enclosures
for Fluid Conveying Components

J. Underwriters' Laboratories (UL):

246.....Hydrants for Fire-Protection Service

262.....Gate Valves for Fire-Protection Service

312.....Check Valves for Fire-Protection Service

405.....Fire Department Connection Devices

753.....Alarm Accessories for Automatic Water-Supply
Control Valves for Fire Protection Service

789.....Indicator Posts for Fire-Protection Service

1091.....Butterfly Valves for Fire-Protection Service

1285.....Pipe and Couplings, Polyvinyl Chloride (PVC),
and Oriented Polyvinyl Chloride (PVCO) for
Underground Fire Service

1.9 WARRANTY

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.10 MATERIALS

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption and shall be certified in accordance with NSF/ANSI 61 or NSF 372.
- B. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended.

2.11 FACTORY-ASSEMBLED PRODUCTS

- A. Standardization of components shall be maximized to reduce spare part requirements. The contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.12 SAFETY GUARDS

- A. All equipment shall have moving parts protected to prevent personal injury. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 1/4-inch (6 mm) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.13 LIFTING ATTACHMENTS

- A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments

shall withstand any handling conditions that might be encountered,
without bending or distortion of shape, such as rapid lowering and
braking of load.

2.14 DUCTILE IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, round-grooved ends.
 - 1. Grooved-End, Ductile-Iron Pipe Appurtenances: ASTM A47, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe, 350 psi (3400 kPa).
 - 2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions, Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
 - 3. Gaskets: AWWA C111.
- D. Flanged Ductile Iron Pipe: AWWA C115/A21.11, with factory applied screwed long hub flanges.
 - 1. Flanges: ASME B16.1 for 125 psi (850 kPa) pressure ratings, as necessary.
 - 2. Wall Sleeve Castings, size and types shown on the drawings, shall be hot dipped galvanized per ASTM A123.
 - 3. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall be

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shop primed with one coat of rust inhibitive primer. Final paint color shall match the final wall color.

- E. Cement Mortar Internal Lining: Cement mortar lining and bituminous seal coat as per AWWA C104.
- F. Exterior Pipe Coating: The exterior of pipe shall have the standard asphaltic coating.
- G. All underground fire service piping to be flushed at the flow rates specified in NFPA 24.

2.15 VALVES

- A. Gate Valves: AWWA C509, Non-rising Stem, Resilient Seat, 200 psi (1380 kPa).

- 1. Valves 3 inches (75 mm) and larger: Resilient seat valve with gray- or ductile iron body and bonnet; cast iron or bronze double-disc gate; bronze gate rings; non-rising bronze stem and stem nut.
- 2. Interior and exterior coating: AWWA C550, thermo-setting or fusion epoxy.
- 3. Underground valve nut: Furnish valves with 2-inch (50 mm) nut for socket wrench operation.
- 4. Aboveground and pit operation: Furnish valves with hand wheels.
- 5. End connections shall match main line pipe.

- B. Gate Valve Accessories and Specialties

- 1. Tapping-Sleeve Assembly: ANSI MSS SP-60; sleeve and valve to be compatible with the drilling matching.
 - a. Tapping Sleeve: Ductile Iron, two-piece bolted sleeve. Sleeve to match the size and type of pipe material being tapped.
 - b. Valve shall include one raised face flange mating tapping-sleeve flange.
- 2. Valve Boxes: AWWA M44 with top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel.
- 3. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut. (Provide two wrenches for Project.)

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4. Indicator Posts: UL 789, FMG approved, vertical type, cast iron body with operating wrench, extension rod, and adjustable cast iron barrel of length required for depth of burial of valve.
- C. Plug Valves: ANSI MSS SP-108, resilient-seated eccentric plug valve, minimum pressure of 175 psi (1207 kPa).
- D. Post-Indicator: NFPA 24 and be fully compatible with the valve and supervisory switches.
- E. Backflow Preventer
 1. Backflow Preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.
 2. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.
 3. Backflow Preventer shall be accessed and have clearances for the required testing, maintenance and repair. Access and clearances shall maintain a minimum of 1 foot (305 mm) between the lowest portion of the assembly and grade, floor or platform. Installations elevated more than 5 feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.
4. Valves:
 - a. Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller.
 - b. OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
- F. Backflow Preventer Test Kits
 1. Provide factory calibrated test kit with gauges, fittings, hoses and carrying case with test-procedure instructions.

2.16 WATER METER BOXES

- A. Cast iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.
 1. Base section may be cast iron, PVC, PE, or another pipe.
- B. Cast iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover;

air space between covers; and slotted, open-bottom base section of length to fit over service piping.

- C. Polymer-concrete body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping, vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 mm by 254 mm) square.

2.17 FIRE HYDRANTS

- A. All hydrants shall have removable interiors capable of replacement without digging up the hydrant and be packable under pressure. Threaded joints or spindles shall be bronze and upper and lower barrels shall be of equal diameter. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 4 inches (100 mm) above finished grade. All fire hydrants shall have 6-inch (150 mm) bottom connection. Provide 2 of hydrant wrenches not less than 14 inches (350 mm) long. Pressure Rating: 150 psi (1035 kPa) minimum. Hydrant valve shall open by turning operating nut to left or counterclockwise. Exterior finish shall be red alkyd-gloss enamel paint, unless otherwise indicated. Outlet threads shall meet NFPA 1963, with external hose thread used by local fire department. Include cast iron caps with steel chains and Pentagon, 1-1/2-inch (38 mm) point to flat operating and cap nuts.

B. Dry-Barrel Fire Hydrants:

1. AWWA C502, freestanding, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4 inch (133 mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet; interior coating according to AWWA C550; cast iron body, compression-type valve opening against pressure and closing.
2. UL 246, freestanding, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4 inch (133 mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet; cast iron body, compression-type valve opening against pressure and closing.

C. Wet-Barrel Fire Hydrants:

1. AWWA C503, freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and

base section with NPS 6 (DN 150) mechanical-joint inlet; interior coating according to AWWA C550.

2. UL 246, freestanding, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet.

2.18 FIRE DEPARTMENT CONNECTIONS

- A. Fire system base water supply must provide a minimum of 1000 gpm (3785 l/m) at 150 psi (1035 kPa) and 700 gpm (2650 l/m) at 200 psi (1380 kPa) at the Fire Department connection. For hydraulic calculations, the calculated demand shall not fall less than 10 percent below the water supply curve.
- B. Fire Department connections: UL 405, NFPA 1963, freestanding, cast bronze body, thread inlets, and matching local fire department hose threads, threaded bottom outlet, lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18 inch (460 mm) high brass sleeve; round escutcheon plate, meeting the requirements of UL 405.
 1. Connections: Two NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) NPS 6 (DN 150) outlet

2.19 ALARM DEVICES

- A. Alarm Devices-General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psi (1725-kPa) working pressure; designed for horizontal or vertical installation; 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

- A. Warning tape shall be standard, 4 mil. Polyethylene, 3 inch (76 mm) wide tape, detectable type, blue with black letters and imprinted with "CAUTION BURIED WATER LINE BELOW".

PART 3 - EXECUTION

3.21 PIPING APPLICATIONS

- A. Use pipe, fittings, and joining methods for piping systems according to the following applications.
 - 1. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
 - 2. Do not use flanges or unions for underground piping.
 - 3. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- B. Underground water-service piping to match existing on site.
- C. Underground water-service piping to match existing on site. NPS 4 to NPS 8 (DN 100 to DN 200) Insert pipe size range shall be the following:
 - 1. Soft copper tube with wrought-copper, solder-joint fittings; and brazed joints.
 - 2. Ductile iron, push-on-joint fittings; and gasketed.
- D. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) Piping shall be the following:
 - 1. Ductile Iron, push-on-joint fittings; and gasketed.

3.22 VALVE APPLICATIONS

- A. Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, non-rising-stem, metal resilient -seated gate valves with valve box.

2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts:
UL/FMG, cast iron, non-rising-stem gate valves with indicator post.
3. Use the following for valves in vaults:
 - a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, non-rising rising stem.
 - b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.

3.23 DUCTILE IRON PIPE

- A. Install Ductile Iron, water-service piping according to AWWA C600 and AWWA M41-3rd Edition.
 1. Install PE corrosion-protection encasement according to ASTM A674 or AWWA C105/A21.5.
- B. Pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.
- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Push on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead.

3.24 ANCHORAGE INSTALLATION

- A. Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include: concrete thrust blocks.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 1. Gasketed-Joint, Ductile Iron, Water-Service Piping: According to AWWA C600.
 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 3. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

- A. AWWA Valves: Install each underground valve with stem pointing up and with valve box.
- B. Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.
- C.

3.26 CONCRETE VAULT INSTALLATION

- A. Install precast concrete vaults according to ASTM C891.

3.27 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install concrete base level and with top approximately 2 inches (50 mm) above grade.
- B. Install protective enclosure over valves and equipment and anchor protective enclosure to concrete base.

3.28 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire department connection to mains.
- B. Install protective pipe bollards on two sides of Describe arrangement each fire department connection.

3.29 FIRE HYDRANT INSTALLATION

- A. Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Install Wet-Barrel Fire Hydrants with valve below frost line. Provide for drainage.

3.30 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. Install water service lines to a point of connection within approximately 5 feet (1500 mm) outside of building(s) to which service is to be connected and make connections thereto. If building services have not been installed provide temporary caps and mark for future connection.

3.31 FIELD QUALITY CONTROL

- A. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before

testing and apply test pressure to stabilize system. Use only potable water.

- B. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
- C. Perform hydrostatic tests at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psi (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psi (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare reports of testing activities.

3.32 IDENTIFICATION

- A. Install continuous underground warning tape 12 inches (300 mm) directly over piping.

3.33 CLEANING

- A. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
- B. Use purging and disinfecting procedure prescribed by local utility provider or other authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - 1. Fill the water system with a water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - 2. Drain the system of the previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow system to stand for 3 hours.
 - 3. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - 4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- C. Prepare reports of purging and disinfecting activities.

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Contract #36C77622R0059
Carrollton GA 30117

Project #508-349

03-01-17

--- E N D ---

SECTION 33 30 00
SANITARY SEWER UTILITIES

PART 1 -GENERAL

1.1 Description

- A. This section specifies materials and procedures for construction of outside, underground sanitary sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 Related Work

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- C. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATION.
- D. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 Definitions

1.4 Abbreviations

- A. PVC: Polyvinyl chloride plastic
- B. DI: Ductile iron pipe

1.5 Delivery, Storage and Handling

- A. Store plastic piping protected from direct sunlight and support to prevent sagging and bending. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.
- B. Handle manholes according to manufacturer's written rigging instructions.

1.6 Coordination

- A. Coordinate connection to sanitary sewer main with Public Utility company. (Approval from public utility has been obtained indicating that the downstream sanitary systems have sufficient capacity to handle the sanitary discharge from the facility.)
- B. Contractor to obtain approval from the Public Agency that the existing sanitary sewer systems have the capacity to handle the discharge from the facility.
- C. Coordinate exterior utility lines and connections to building lines up to 5 feet of building wall.
- D. Coordinate connection to public sewer system with Public Utility Company.

1.7 Quality Assurance:

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.8 Submittals:

- A. Manufacturers' Literature and Data shall be submitted for the following as one package:
 - 1. Pipe, Fittings, and, Appurtenances.
 - 2. Jointing Material.
 - 3. Manhole and Structure Material.
 - 4. Frames and Covers.
 - 5. Steps and Ladders.

PART 2 -PRODUCTS

2.1 Applicable Publications

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A74-09.....Cast Iron Soil Pipe and Fittings
A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for
Concrete
A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement
A746-99.....Ductile-Iron Gravity Sewer Pipe
C478-09.....Precast Reinforced Concrete Manhole Sections
C857-11.....Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures
C890-11.....Minimum Structural Design Loading for
Monolithic or Sectional Precast Concrete Water
and Wastewater Structures
C913-08.....Precast Concrete Water and Wastewater
Structures
C923-08.....Resilient Connectors Between Reinforced
Concrete Manhole Structures, Pipes, and
Laterals
C924-02 (2009).....Testing Concrete Pipe Sewer Lines by Low-
Pressure Air Test Method
C990-09.....Joints for Concrete Pipe, Manholes, and precast
Box Sections using Preformed Flexible Joint
Sealants
C1173-10.....Flexible Transition Couplings for Underground
Piping Systems
C1440-08.....Thermoplastic Elastomeric (TPE) Gasket
Materials for Drain, Waste and Vent (DWV),
Sewer, Sanitary and Storm Plumbing Systems
C1460-08.....Shielded Transition Couplings for Use with
Dissimilar DWV Pipe and Fittings Above Ground
C1461-08.....Mechanical Couplings Using Thermoplastic
Elastomeric (TPE) Gaskets for Joining Drain,

Waste and Vent (DWV), Sewer, Sanitary and Storm
Plumbing systems for Above and below Ground Use
D2321-11.....Underground Installation of Thermoplastic Pipe
for Sewers and Other Gravity-Flow Applications
D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe
and Fittings
F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings
F891-10.....Coextruded Poly(vinyl Chloride) (PVC) Plastic
Pipe with a Cellular Core
F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer
Pipe with a Smooth Interior and Fittings
F1417-11.....Standard Test Method for Installation
Acceptance of Plastic Gravity Sewer Lines Using
Low-Pressure Air
F1668-08.....Construction Procedures for Buried Plastic Pipe

C. American Water Works Association (AWWA):

C105/A21.5-10.....Polyethylene Encasement for Ductile-Iron Pipe
Systems
C110-08.....Ductile-Iron and Gray-Iron Fittings
C111/A21.11-06.....Rubber Gasket Joints for Ductile Iron Pressure
Pipe and Fittings
C151/A21.51-09.....Ductile Iron Pipe, Centrifugally Cast
C153/A21.53-06.....Ductile Iron Compact Fittings for Water Service
C219-11.....Bolted, Sleeve-Type Couplings for Plain-End
Pipe
C512-07.....Air Release, Air/Vacuum and Combination Air
Valves for Water Works Service
C600-10.....Installation of Ductile-Iron Mains and Their
Appurtenances
C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and
Fabricated Fittings, 4 In. Through 12 In. (100
mm Through 300 mm), for Water Transmission and
Distribution

D. American Society of Mechanical Engineers:

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

2.2 Warranty

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will provide all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

2.3 Products

2.4 Factory-Assembled Products

- A. Standardization of components shall be maximized to reduce spare part requirements.
- B. All pipe and fittings used in the construction of force mains shall be rated to meet the system maximum operating pressure with a minimum of 150 psi (1035 kPa).
- C. The Contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.5 Ductile-Iron Pipe and Fittings

- A. Push-on-Joint Piping:
1. Pipe: AWWA C151, thickness SDR 35, with bolt holes in bell.
 2. Standard Fittings: AWWA C110.
 3. Compact Fittings: AWWA C153.
 4. Gaskets: AWWA C111.
 5. Exterior coating: AWWA C151.
 6. Interior lining: AWWA C151.
 7. Pipe and fittings shall be polyethylene encased as per AWWA C105.

2.6 PVC, Gravity Sewer Pipe and Fittings

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings shall conform to ASTM D3034 SDR 35.
2. Gaskets: ASTM F477.

2.7 Cleanouts

A. Cast-Iron Cleanouts:

1. Cleanouts shall be as per ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Valve loadings shall be designed for Heavy Duty.
3. Cleanout Riser: Sewer pipe fitting on main line pipe and riser shall be as per ASTM A74, service class.

B. PVC Cleanouts:

1. PVC body with PVC threaded plug: Cleanout shall be as per ASTM D3034. PVC sewer pipe fitting and riser to clean out.
2. Cleanout Riser: Sewer pipe fitting on main line sewer and riser shall match main line piping.

2.8 Manholes

A. Standard precast concrete manholes and vaults shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections or cast-in-place concrete.

1. Precast Concrete Manholes: Material shall be as per ASTM C478, precast, reinforced concrete, of depth indicated, with sealed joints.
2. Concrete Base: Concrete for base of manhole shall have a minimum compressive strength of 5000 psi (35 MPa) at 28 days. Thickness to be 8 inches (200 mm), minimum.
3. Riser Section: 4 inch (100 mm) minimum thickness, of lengths to provide the total depth of manhole.
4. Top Section: Eccentric-cone type unless otherwise indicated. Top section to match adjustment ring configurations.
5. Joint Sealant: ASTM C990.
6. Resilient Pipe Connectors: ASTM C923.

7. Steps: If over 60 inches (1500 mm) in depth, individual FRP steps or ladder ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in precast concrete sections , with 16 inch (400 mm) minimum width, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
8. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Concrete Manholes:

1. Description: ASTM C913; designed according to ASTM C890 for AASHTO HS20-44, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: If over 60 inches (1500 mm) in depth, individual FRP steps or FRP ladder individual FRP steps, FRP ladder, or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in Insert material ; width 16 inches (400 mm) minimum, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
6. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

- C. Manhole Base Channels: Manhole channels shall be main line pipe material. Lay main pipe through manhole and cut top of pipe out to be three-fourths of pipe diameter. Slope through manhole to match run slopes of the main pipe.

2.9 Concrete

- A. Cast-in-place concrete shall be 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
- B. Reinforcement

1. Reinforcing fabric shall be ASTM A185, steel, welded wire fabric, plain.
 2. Reinforcing bars shall be ASTM A615, Grade 60 (420 MPa) deformed steel.
- C. Benches shall be concrete, sloped to drain into the channel. Provide 6 inches (150 mm) from the cut section of top of pipe to edge of manhole.
- D. Ballast and Pipe Supports shall be Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

PART 3 -EXECUTION

3.1 Warning Tape

- A. Warning tape shall be standard, 4 mil (0.1 mm) polyethylene 3 inch (76 mm) wide tape detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

3.2 Execution

3.3 Piping Installation

- A. Drawing plans and details indicate the general location and arrangement of underground sanitary sewer piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at the low point, true to grades and alignment indicated on the drawings, with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- D. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- E. Inspect pipes and fittings for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches (300 mm) over the crown of the pipe.
- H. Warning tape shall be continuously placed 12 inches (300 mm) above sewer pipe
- I. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- J. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- K. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.
- L. Install gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install piping with 36 inches (915 mm) minimum cover as shown on Drawings.
 - 3. Install ductile iron, gravity sewer piping according to AWWA C600.
 - 4. Install PVC cellular-core, PVC corrugated sewer, PSM sewer and PVC gravity sewer according to ASTM D2321 and ASTM F1668.
- M. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.4 Pipe Joint Construction

- A. Join gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Join ductile iron, gravity sewer piping according to AWWA C600 for push-on joints.
 - 2. Join PVC piping according to ASTM D2321.

3. Join dissimilar pipe materials with non-pressure-type, flexible or rigid couplings.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
 - a. Unshielded Shielded Flexible or Rigid couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.5 Sewer and Manhole Supports, Concrete Cradles within vaults

- A. Install reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

3.6 Building Service Lines

- A. Install sanitary sewer service lines to point of connection within approximately 5 feet (1500 mm) outside of building(s) where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

3.7 Manhole Installation

- A. Install manholes complete with appurtenances and accessories indicated.
 1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
 2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed as per manufacturer's recommendations. Adjust the

length of the rings so that the top section will be at the required elevation. Cutting the top section is not acceptable.

3. Concrete manhole risers and tops: Install as specified.

B. Designed Concrete Structures:

1. Concrete structures shall be installed in accordance with Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Do not build structures when air temperature is 32 deg F (0 deg C), or below.

D. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.

E. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.

F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade.

G. Install manhole frames and covers on a mortar bed, such that frames, and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. Install 8 inches (200 mm) thick, by 12 inches (300 mm) wide concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

H.

3.8 Cleanout Installation

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Cleanouts should be 6 inches (150 mm) in diameter and consist of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, watertight plug or cap and cast frame and cover flush with finished grade. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete, 18 by 18 by 12 inches (450 by 450 by 300 mm) 1 inch (25 mm) above surrounding grade.
- C. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with 2 inches (50 mm) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 24 inches (600 mm) in diameter.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.
- E. The top of the cleanout assembly shall be 2 inches (50 mm) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.9 Connections

- A. Make connections to existing piping and underground manholes by coring and installing the pipe at the design invert. Install an elastomeric gasket around the pipe and grout the interstitial space between the pipe and the core.
- B. Connection to an existing manhole: The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all new pipes connected to the manhole.
- C. Use commercially manufactured wye fittings for piping branch connections. Encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 1. Make branch connections from the side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500), by removing a section of the existing pipe.
 2. Make branch connections from the side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting an opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to

shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in concrete to provide additional support of collar from connection to undisturbed ground.

3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.10 Regrading

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure and shall prevent debris from entering the wastewater stream.

3.11 Pipe Separation

- A. Horizontal Separation - Water Mains and Sewers:
 1. Existing and proposed water mains shall be at least 10 feet (3 m) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
 2. Gravity flow mains and pressure (force) mains may be located closer than 10 feet (3 m) but not closer than 6 feet (1.8 m) to a water main when:
 - a. Local conditions prevent a lateral separation of 10 feet (3 m); and
 - b. The water main invert is at least 18 inches (450 mm) above the crown of the gravity sewer or 24 inches (600 mm) above the crown

of the pressure (force) main; and the water main is in a separate trench separated by undisturbed earth.

3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 24 inches (600 mm) above the crown of gravity flow sewer or 48 inches (1200 mm) above the crown of pressure (force) mains. The vertical separation shall be maintained within 10 feet (3 m) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
2. In no case shall pressure (force) sanitary main cross above, or within 24 inches (600 mm) of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 18 inches (450 mm) above or 12 inches (300 mm) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 24 inches (600 mm) below the water line provided both the water line and sewer line are constructed of ductile iron pipe.
4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 10 feet (3 m).

3.12 Identification

- A. Install green warning tape directly over piping and at outside edges of underground manholes.

3.13 Field Quality Control

- A. All systems shall be inspected and obtain the COR's approval. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

- B. To inspect, thoroughly flush out the lines and manholes before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lips at joints on the inside of gravity sewer lines are not acceptable.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.
- C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - 1. Test plastic gravity sewer piping according to ASTM F1417.
 - 2. Test concrete gravity sewer piping according to ASTM C924.
 - 3. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 4 psi (28 kPa) and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 psi (24 kPa) greater than the average backpressure of any groundwater above the sewer.
 - 4. For force mains, perform testing after supports and anchors are installed. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
 - 5. Testing of Fiberglass Sewage Holding Tanks shall show no leakage during a 5 psi (35 kPa) air pressure test with 5:1 safety factor.
 - 6. Testing of Concrete Wet Well shall show no leakage with the wet well completely filled with water for a duration of 4 hours.

3.14 Cleaning

VA Atlanta TVDD 12 Bed CLC
Contract #36C77622R0059
Carrollton GA 30117

Project #508-349

A. Clean dirt and superfluous material from interior of piping.

--- E N D ---

SECTION 33 40 00

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.
- E. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- F. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 COORDINATION

- A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.
- B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

- A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 SUBMITTALS

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

1.9 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for
Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009).....Ductile Iron Castings

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

A760/A760M-10.....Corrugated Steel Pipe, Metallic-Coated for
Sewers and Drains

A798/A798M-07.....Installing Factory-Made Corrugated Steel Pipe
for Sewers and Other Applications

A849-10.....Post-Applied Coatings, Paving, and Linings for
Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01(2007).....Steel Sheet, Metallic-Coated by the Hot-Dip
Process for Corrugated Steel Pipe

B745/B745M-97(2005).....Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09.....Installing Factory-Made Corrugated Aluminum
Culverts and Storm Sewer Pipe

C14-07.....Non-reinforced Concrete Sewer, Storm Drain, and
Culvert Pipe

C33/C33M-08.....Concrete Aggregates

C76-11.....Reinforced Concrete Culvert, Storm Drain, and
Sewer Pipe

C139-10.....Concrete Masonry Units for Construction of
Catch Basins and Manholes

C150/C150M-11.....Portland Cement

C443-10.....Joints for Concrete Pipe and Manholes, Using
Rubber Gaskets

C478-09.....Precast Reinforced Concrete Manhole Sections

C506-10b.....Reinforced Concrete Arch Culvert, Storm Drain,
and Sewer Pipe

C507-10b.....Reinforced Concrete Elliptical Culvert, Storm
Drain, and Sewer Pipe

C655-09.....Reinforced Concrete D-Load Culvert, Storm
Drain, and Sewer Pipe

C857-07.....Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures

C891-09.....Installation of Underground Precast Concrete
Utility Structures

C913-08.....Precast Concrete Water and Wastewater
Structures

C923-08.....Resilient Connectors Between Reinforced
Concrete Manhole Structures, Pipes, and
Laterals

C924-02 (2009).....Testing Concrete Pipe Sewer Lines by Low-
Pressure Air Test Method

C990-09.....Joints for Concrete Pipe, Manholes, and Precast
Box Sections Using Preformed Flexible Joint
Sealants

C1103-03(2009).....Joint Acceptance Testing of Installed Precast
Concrete Pipe Sewer Lines

C1173-08.....Flexible Transition Couplings for Underground
Piping Systems

C1433-10.....Precast Reinforced Concrete Monolithic Box
Sections for Culverts, Storm Drains, and Sewers

C1479-10.....Installation of Precast Concrete Sewer, Storm
Drain, and Culvert Pipe Using Standard
Installations

D448-08.....Sizes of Aggregate for Road and Bridge
Construction

D698-07e1.....Laboratory Compaction Characteristics of Soil
Using Standard Effort (12,400 ft-lbf/ft³ (600
kN-m/m³))

D1056-07.....Flexible Cellular Materials—Sponge or Expanded
Rubber

D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe,
Schedules 40, 80, and 120

D2321-11.....Underground Installation of Thermoplastic Pipe
for Sewers and Other Gravity-Flow Applications

D2751-05.....Acrylonitrile-Butadiene-Styrene (ABS) Sewer
Pipe and Fittings

D2774-08.....Underground Installation of Thermoplastic
Pressure Piping

D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe
and Fittings

D3350-10.....Polyethylene Plastics Pipe and Fittings
Materials

- D3753-05e1.....Glass-Fiber-Reinforced Polyester Manholes and
Wetwells
- D4101-11.....Polypropylene Injection and Extrusion Materials
- D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain,
Waste, and Vent (DWV), Sewer, Sanitary, and
Storm Plumbing Systems
- F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
- F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings
- F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based
on Outside Diameter
- F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity
Sewer Pipe and Fittings Based on Controlled
Inside Diameter
- F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic
Pipe With a Cellular Core
- F894-07.....Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drainpipe
- F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer
Pipe With a Smooth Interior and Fittings
- F1417-11.....Installation Acceptance of Plastic Gravity
Sewer Lines Using Low-Pressure Air
- F1668-08.....Construction Procedures for Buried Plastic Pipe
- C. American Association of State Highway and Transportation Officials
(AASHTO):
- M190-04.....Bituminous-Coated Corrugated Metal Culvert Pipe
and Pipe Arches
- M198-10.....Joints for Concrete Pipe, Manholes, and Precast
Box Sections Using Preformed Flexible Joint
Sealants
- M252-09.....Corrugated Polyethylene Drainage Pipe

M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300
to 1500 mm) Diameter

D. American Water Works Association (AWWA):

C105/A21.5-10.....Polyethylene Encasement for Ductile iron Pipe
Systems

C110-08.....Ductile-Iron and Gray-Iron Fittings

C219-11.....Bolted, Sleeve-Type Couplings for Plain-End
Pipe

C600-10.....Installation of Ductile iron Mains and Their
Appurtenances

C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and
Fabricated Fittings, 4 In. Through 12 In. (100
mm Through 300 mm), for Water Transmission and
Distribution

M23-2nd ed.....PVC Pipe "Design And Installation"

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

F. American Concrete Institute (ACI):

318-05.....Structural Commentary and Commentary

350/350M-06.....Environmental Engineering Concrete Structures
and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for
Erosion and Sediment Control

1.10 WARRANTY

The Contractor shall remedy any defect due to faulty material or
workmanship and pay for any damage to other work resulting therefrom
within a period of one year from final acceptance. Further, the
Contractor will furnish all manufacturers' and suppliers' written
guarantees and warranties covering materials and equipment furnished
under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 PE PIPE AND FITTINGS

A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.

B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); AASHTO M294, Type S ASTM F714, SDR 21 for pipes 3 to 24 inches (300 to 600 mm) with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Watertight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil tight joints shall conform to requirements in AASHTO HB-17, Division II, for soil tightness and shall be as recommended by the manufacturer.

C. PVC Pipe And Fittings

1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, SDR 35 PVC socket-type fittings.

D. PVC Corrugated Sewer Piping

1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F477, elastomeric seals.

E. PVC Profile Sewer Piping

1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

F. PVC Gravity Sewer Piping

1. Pipe and fittings shall be ASTM F679, T-1 T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.
2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

2.3 DRAINS

A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Top-Loading Classification(s): Medium and Heavy Duty

2.4 ENCASEMENT FOR PIPING

A. Material: AWWA C105 Linear low-density polyethylene film of 0.008 inch (0.20 mm) or high-density, cross-laminated polyethylene film of 0.004 inch (0.10 mm) minimum thickness.

B. Form: Sheet or tube

C. Color: Black or natural

2.5 MANHOLES AND CATCH BASINS

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.

8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps or FRP ladder
Individual FRP steps; FRP ladder; width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

2.6 CONCRETE FOR MANHOLES AND CATCH BASINS

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
 1. Cement: ASTM C150, Type II.
 2. Fine Aggregate: ASTM C33, sand.
 3. Coarse Aggregate: ASTM C33, crushed gravel.
 4. Water: Potable.
- B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.
 1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.
 1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6-inch slope from main line pipe to wall sides.
 - a.

2.7 PLASTIC, CHANNEL DRAINAGE SYSTEMS

- A. General Requirements for Plastic, Channel Drainage Systems:
 1. Modular system of plastic channel sections, grates, and appurtenances.
 2. Designed so grates fit into frames without rocking or rattling.
 3. Number of units required to form total lengths indicated.
- B. PE Systems:

1. Channel Sections: Interlocking-joint, PE modular units, 4 inches (102 mm) wide, with end caps. Include rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
2. Grates: PE, ladder shaped; with stainless-steel screws.
3. Color: Gray unless otherwise indicated.
4. Drainage Specialties: Include the following PE components:
 - a. Catch Basins: 12 inch (305 mm) square plastic body, with outlets in quantities and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.
- C. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
- D. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.8 PIPE OUTLETS

- A. Head walls: Cast in-place reinforced concrete, with apron and tapered sides.
- B. Riprap basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 1. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
- C. Filter Stone: NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
- D. Energy Dissipaters: To be as per NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.
- E.

2.9 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

- A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets and shall conform to ASTM C923.

2.10 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, green with black letters, and imprinted with "CAUTION BURIED STORM DRAIN LINE BELOW".

PART 3 - EXECUTION

3.1 PIPE BEDDING

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with 36 inch (915 mm) minimum cover as shown on the Drawings.
- C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
 2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
 3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

4. Clean interior of all pipes thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
 5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
 6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
 7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.
 - D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
 - E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
 - F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
 - G. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow.
 2. Install corrugated steel piping according to ASTM A798.
 3. Install ABS sewer piping according to ASTM D2321 and ASTM F1668.
 4. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints.
 5. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.
- 1) .

3.3 REGRADING

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.
- C. Set drain frames and covers with tops flush with pavement surface.
- D. Assemble trench sections with flanged joints and embed trench sections in 4 inch (102 mm) minimum concrete around bottom and sides.

3.6 MANHOLE INSTALLATION

- A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
- C. Circular Structures:
1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
 2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the

required elevation. Cutting the conical top section is not acceptable.

3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on an 8 inch (200 mm) reinforced concrete pad or be provided with a precast concrete base section. Structures provided with a base section shall be set on an 8 inch (200 mm) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.
2. Do not build structures when the air temperature is 32 deg F (0 deg C), or below.
3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
 - a. Forming directly in concrete base of structure.
 - b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.
5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8-inch (203 mm) thick, by 12-inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.7 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete.
- B. Construct riprap of broken stone.
- C. Install outlets that spill onto grade, anchored with concrete.
- D. Install outlets that spill onto grade, with flared end sections that match pipe.
- E. Construct energy dissipaters at outlets.

3.9 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.
- B. Encase entire connection fitting, plus 6-inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
- C. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
 - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
 - 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8 inch (203 mm) thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Backfill to grade according to Division 31 Section EARTH MOVING.

3.11 IDENTIFICATION

- A. Install green warning tape directly over piping and at outside edge of underground structures.

3.12 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.

- b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
- c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
- d. Infiltration: Water leakage into piping.
- e. Exfiltration: Water leakage from or around piping.
- 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
- 4. Reinspect and repeat procedure until results are satisfactory.

3.13 TESTING OF STORM SEWERS:

- A. Submit separate report for each test.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
 - 4. Submit separate report for each test.
 - 5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
 - 6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa)
 - a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
 - b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
- C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

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Contract #36C77622R0059
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12-01-17

3.14 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

--- E N D ---

SECTION 33 51 00
NATURAL-GAS DISTRIBUTION

PART 1 -GENERAL

1.1 Description

- A. This section specifies materials and procedures for the construction of outside underground gas distribution system for natural gas, complete, ready for operation, including cathodic protection if required, all appurtenant structures, and connections to new building structures and to existing gas supply. This specification does not apply to LPG distribution systems.

1.2 Related work

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
- D. Where soil resistivity is less than 4000 ohm-cm or when required by gas utility, Section 26 42 00, CATHODIC PROTECTION.
- E. Metering: SECTION 25 10 10, ADVANCED UTILITY METERING SYSTEM.

1.3 Definitions

- A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 Abbreviations

- A. HDPE: High-density polyethylene plastic
- B. PE: Polyethylene plastic
- C. WOG: Water, oil and gas
- D. NRTL: National recognized testing laboratory

1.5 Delivery, Storage, And Handling

- A. Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.6 Coordination

- A. Coordinate connection to natural-gas main with Utility Company.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 Quality Assurance:

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. A nameplate bearing the manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Utility Company having jurisdiction over the connection to public natural-gas lines and the extension, and/or modifications to public utility systems.

1.8 Applicable Publications

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American National Standards Institute (ANSI):

- B31.8-2010.....Gas Transmission and Distribution Piping Systems
- B109.1-92.....Diaphragm-Type Gas Displacement Meters (Under 500-Cubic-Feet-per-hour Capacity)
- B109.2-2000.....Diaphragm-Type Gas Displacement Meters (500-Cubic-Feet-per-hour Capacity and over)
- B109.3-92.....Rotary-Type Gas Displacement Meters
- IAS LC 1-2005.....Fuel Gas Piping Systems Using Corrugated Stainless-Steel Tubing (CSST)
- Z21.18-07/CSA 6.3-07....Gas Appliance Pressure Regulators
- Z21.21-2005/CSA 6.5.....Automatic Valves for Gas Appliances
- Z21.41-2003/CSA 6.9.....Quick Disconnect Devices for Use with Gas Fuel Appliances
- Z21.75-2007/CSA 6.27....Connectors for Outdoor Gas Applications and Manufactured Homes
- Z21.80a-2005/CSA 6.22a..Line Pressure Regulators, Addenda 1 to Z21.80-2003/CSA 6.22
- C. American Petroleum Institute (API):
 - Spec 6D-2010.....Pipeline Valves
- D. American Society of Civil Engineers (ASCE):
 - 25-06.....Earthquake Actuated Automatic Gas Shutoff Devices
- E. American Society of Mechanical Engineers (ASME):
 - B1.20.1-1983.....Pipe Threads, General Purpose, Inch
 - B1.20.3-2008.....Dryseal Pipe Threads (Inch)
 - B16.3-2006.....Malleable Iron Threaded Fittings: Classes 150 and 300
 - B16.5-2009.....Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
 - B16.9-2007.....Factory-Made Wrought Buttwelding Fittings
 - B16.11-2009.....Forged Fittings, Socket-Welding and Threaded
 - B16.20-2007.....Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
 - B16.26-2006.....Cast Copper Alloy Fittings for Flared Copper Tubes
 - B16.33-2002.....Manually Operated Metallic Gas Valves for use in Gas Piping Systems up to 125 psi (Sizes NPS 1/2 through NPS 2)

- B16.34-2009.....Valves - Flanged, Threaded and Welded End
- B16.38-2007.....Large Metallic Valves for Gas Distribution
Manually Operated, NPS 2-1/2 (DN 65) to NPS 12
(DN 300), 125 psi (8.6 bar) Maximum
- B16.39-2009.....Malleable Iron Threaded Pipe Unions: Classes
150, 250, and 300
- B16.40-2008.....Manually Operated Thermoplastic Gas Shutoffs
and Valves in Gas Distribution Systems
- B18.2.1-2010.....Square, Hex, Heavy Hex, and Askew Head Bolts
and Hex, Heavy Hex, Hex Flange, Lobed Head, and
Lag Screws (Inch Series)
- B31.8-2010.....Gas Transmission and Distribution Piping
Systems
- MFC-4M-1986.....Measurement of Gas Flow by Turbine Meters
- F. American Society of Safety Engineers (ASSE):
1079-2005.....Dielectric Pipe Unions
- G. American Society for Testing and Materials (ASTM):
A53/A53M-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless
A126-04(2009).....Gray Iron Castings for Valves, Flanges, and
Pipe Fittings
A234/A234M-11.....Piping Fittings of Wrought Carbon Steel and
Alloy Steel for Moderate and High Temperature
Service
A312/A312M-11.....Seamless, Welded, and Heavily Cold Worked
Austenitic Stainless-Steel Pipes
B210-04.....Aluminum and Aluminum-Alloy Drawn Seamless
Tubes
B241/B241M-10.....Aluminum and Aluminum-Alloy Seamless Pipe and
Seamless Extruded Tube
B584-11.....Copper Alloy Sand Castings for General
Applications
D2513-11e1.....Polyethylene (PE) Gas Pressure Pipe, Tubing,
and Fittings
D2517-06.....Reinforced Epoxy Resin Gas Pressure Pipe and
Fittings

- D2683-10.....Socket-Type Polyethylene Fittings for Outside
Diameter-Controlled Polyethylene Pipe and
Tubing
- D2774-08.....Underground Installation of Thermoplastic
Pressure Piping
- D3261-10a.....Butt Heat Fusion Polyethylene (PE) Plastic
Fittings for Polyethylene (PE) Plastic Pipe and
Tubing
- E84-11.....Standard Test Method for Surface Burning
Characteristics of Building Materials
- H. American Water Works Association (AWWA):
- C203-08.....Coal-Tar Protective Coatings and Linings for
Steel Water Pipelines - Enamel and Tape - Hot
Applied
- I. American Welding Society (AWS):
- A5.8/A5.8M:2004.....Filler Metals for Brazing and Braze Welding
D10.12/D10.12M:2000.....Guide for Welding Mild Steel Pipe
- J. Manufacturers Standardization Society (MSS):
- SP-78-2005.....Gray Iron Plug Valves Flanged and Threaded Ends
SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder
Joint, Grooved and Flared Ends
- K. National Fire Protection Agency (NFPA):
- 54-2009.....National Fuel Gas Code
70-2011.....National Electric Code
- L. Society of Automotive Engineers (SAE):
- J513-199901.....Refrigeration Tube Fittings - General
Specifications *HS-150/2000*
- M. Underwriters Laboratories (UL):
- UL 429-2010.....Electrically Operated Valves

1.9 Warranty

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 -- PRODUCTS

2.1 Pipes, Tubes, And Fittings

- A. Steel Pipe: Steel pipe shall be as per ASTM A53, black steel, Schedule 40, Type E or Type S, Grade B. Copper tubes are not allowed by code for natural gas distribution in the United States.
- B. Fittings:
 - 1. Malleable-Iron Threaded Fittings shall meet ASME B16.3, Class 150 or Class 300, standard pattern. Threaded joints are not permitted except at valve connections.
 - 2. Butt weld fittings shall be wrought steel, per ASME B16.9.
 - 3. Wrought-Steel Welding Fittings shall meet ASTM A234 for butt welding and socket welding.
 - 4. Unions shall be ASME B16.39, Class 150 Class 250 or Class 300, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 5. Forged-Steel Flanges and Flanged Fittings shall be ASME B16.5 or ASME B16.11, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections shall be threaded, or butt welded to match pipe.
 - c. Lapped Face is not permitted underground.
 - d. Gasket Materials shall be ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts shall be ASME B18.2.1, carbon steel aboveground and stainless-steel underground.
 - 6. Protective Coating for Underground Piping:
 - a. Factory-applied, three-layer coating of epoxy, adhesive, and polyethylene PE).
 - b. Coal Tar Enamel Coating on exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal-tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt shall not be used; felt material shall be fibrous-glass mat as specified in Appendix Sec. A2.1 of AWWA C203.
 - c. Joint cover kits shall include epoxy paint, adhesive, and heat-shrink PE sleeves.

7. Mechanical Couplings shall include:
 - a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Couplings shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anodes.
- C. Corrugated, Stainless-Steel Tubing shall comply with ANSI/IAS LC 1 and ASTM A312, corrugated, Series 300 stainless steel.
 1. Coating shall be PE with flame retardant with surface-burning characteristics determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
 2. Fittings shall be copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 3. Striker Plates shall be steel, designed to protect tubing from penetration.
 4. Manifolds shall be malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 5. Operating-Pressure Rating shall be 5 psi (34.5 kPa).
- D. Aluminum Tubing shall comply with ASTM B210 and ASTM B241/B241M.
 1. Aluminum Alloy 5456 is prohibited.
 2. Protective coating shall be factory-applied and capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
 3. Flare fittings shall comply with ASME B16.26 and SAE J513-199901 and the following:
 - a. Copper-alloy fittings shall include metal-to-metal compression seal without gasket.
 - b. Dryseal threads shall comply with ASME B1.20.3.
- E. PE Pipe: Pipe shall conform to ANSI B31.8 or ASTM D2513.

1. Minimum wall thickness shall conform to ASME B31.8. PE pipe is for underground use only. Polyethylene pipe shall be marked "GAS" and it is not to be used where gas pressures are above 100 psi (690 kPa) or with operating temperatures below 20 deg F (7 deg C) or above 140 deg F (60 deg C).
2. PE Fittings shall be as per ASTM D2513 ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type .
3. PE Transition Fittings shall be factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53, black steel, Schedule 40, Type E or S, Grade B.
4. Polyethylene pipe joints shall be heat fused, either butt fusion or socket fusion.
5. Anode-less Service-Line Risers shall be factory fabricated and leak tested.
 - a. Underground portion shall be PE pipe complying with ASTM D2513.
 - b. Casing shall be steel pipe complying with ASTM A53, Schedule 40, black steel, Type E or Type S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground portion shall have PE transition fittings. Outlet shall be threaded flanged or suitable for welded connection. Include tracer wire connection and ultraviolet shield.
 - d. Stake supports with factory finish to match steel pipe casing or carrier pipe.
6. Transition Service-Line Risers shall be factory fabricated and leak tested.
 - a. Underground Portion shall be PE pipe complying with ASTM D2513, connected to steel pipe complying with ASTM A53, Schedule 40, Type E or Type S , Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection. Include factory-connected anode, tracer wire connection and ultraviolet shield.
 - c. Stake supports with factory finish to match steel pipe casing or carrier pipe. Bridging sleeve over mechanical coupling.
7. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
 - a. PE body with molded-in, stainless steel support ring.
 - b. Buna-nitrile seals.

- c. Acetal collets.
 - d. Electro-zinc-plated steel stiffener.
- 8. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger shall be Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - a. Fiber-reinforced plastic body.
 - b. PE body tube.
 - c. Buna-nitrile seals.
 - d. Acetal collets.
 - e. Stainless-steel bolts, nuts, and washers.
- 9. Steel Mechanical Couplings shall be capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe. Include:
 - a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Factory-installed anode for steel-body couplings installed underground.
- F. Fiberglass pipe shall conform to ASTM D2517. Pipe sections shall be marked "GAS" and as required by ASTM D2517. Minimum wall thickness shall be based on ASME B31.8.
 - 1. Fiberglass pipe shall not be used where gas pressures are above 100 psi (690 kPa) or with operating temperatures below -20 deg F (-29 deg C) or above 150 deg F (66 deg C).
 - 2. Fiberglass fittings, joints and adhesive shall conform to ASTM D2517.

2.2 Piping Specialties

- A. Outdoor, Appliance Flexible Connectors shall comply with ANSI Z21.75/CSA 6.27, made of corrugated stainless-steel tubing with polymer coating.
 - 1. Operating-Pressure Rating shall be 0.5 psi (3.45 kPa) with zinc-coated steel end fittings. Threaded ends shall comply with ASME B1.20.1. Maximum Length shall be 72 inches (1830 mm).
- B. Quick-Disconnect devices shall comply with ANSI Z21.41/CSA 6.9, having copper-alloy convenience outlet and matching plug connector, nitrile seals. Disconnect should be hand operated with automatic shutoff, rated

for indoor or outdoor applications and have an adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40 60 -mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psi (862 kPa).

D. Basket Strainers:

1. Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40 60 -mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psi (862 kPa).

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40 60 -mesh startup strainer and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psi (5170 kPa).

- F. Weatherproof Vent Cap shall be cast or malleable-iron increaser fitting with corrosion-resistant wire screen, and free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 Joining Materials

- A. Joint Compound and Tape shall be suitable for natural gas.
- B. Welding filler metals shall comply with AWS D10.12 for appropriate wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing filler metals shall be alloy with a melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 Manual Gas Shutoff Valves

- A. All types of valves shall be accessible, labeled and specified for use for controlling multiple systems.
- B. Metallic Valves, NPS 2 (DN 50) and smaller shall comply with ASME B16.33, and have the following characteristics:
 - 1. CWP Rating of 125 psi (862 kPa).
 - 2. Threaded ends complying with ASME B1.20.1.
 - 3. Dryseal threads on flare ends that comply with ASME B1.20.3.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 - 5. Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. Metallic Valves, NPS 2-1/2 (DN 65) and larger shall comply with ASME B16.38.
 - 1. CWP Rating of 125 psi (862 kPa) Insert pressure.
 - 2. Flanged Ends shall comply with ASME B16.5 for steel flanges.
 - 3. The initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim shall comply with MSS SP-110, and have the following characteristics:
 - 1. Bronze body complying with ASTM B584.
 - 2. Chrome-plated brass ball and bronze, blowout proof stem.
 - 3. Seats shall be reinforced TFE and blowout proof.
 - 4. Include separate packnut with adjustable stem packing threaded ends.
 - 5. Ends shall be threaded, flared, or socket and valve shall have a CWP rating of 600 psi (4140 kPa).
 - 6. Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction, suitable for natural-gas service with "WOG" indicated on valve body.
- E. Bronze Plug Valves Cast-Iron, Nonlubricated Plug Valves Cast-Iron, Lubricated Plug Valves shall comply with MSS SP-78, and have the following characteristics:
 - 1. Bronze body complying with ASTM B584 Cast iron complying with ASTM A126, Class B and a bronze plug nickel-plated cast iron.

2. Ends shall be threaded, socket, or flanged and the operator shall be square head or lug type with tamperproof feature where indicated. Pressure class shall be 125 psi (862 kPa).
 3. Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction suitable for natural-gas service with "WOG" indicated on valve body.
- F. Steel valves shall have capacity to operate in lines with 100 psi 690 kPa) working pressure.
1. Valves 1-1/2 inches (40 mm) and smaller installed underground shall conform to ASME B16.34, carbon steel, socket weld ends.
 2. Valves 1-1/2 inches (40 mm) and smaller, installed aboveground, shall conform to ASME B16.34, carbon steel, socket weld or threaded ends.
 3. Valves 2 inches (50 mm) and larger shall conform to API spec 6D, carbon steel, butt weld ends.
 4. Aboveground valves 2 inches or larger (50 mm) shall conform to API Spec 6D, carbon steel, butt weld or flanged ends.
 5. Cast iron valves shall conform to ASTM A126, Class B, Type 301 or 302.
- G. PE Ball Valves shall comply with ASME B16.40. Valves in sizes 1/2 inch to 6 inches (15 mm to 150 mm) may be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only.
1. CWP Rating: 80 psi (552 kPa) Insert pressure with an operating temperature of Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C) Insert temperature range.
- H. Valve Boxes shall be cast iron, two-section boxes.
1. Top section shall include a cover with "GAS" lettering.
 2. Bottom section shall have a base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
 3. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 Motorized Gas Valves

- A. Automatic gas valves shall comply with ANSI Z21.21/CSA 6.5.

- B. Electrically operated valves shall comply with UL 429. Include 120-V ac, 60 Hz, Class B, continuous-duty molded replaceable coil with visual position indicator.

2.6 Earthquake Valves

- A. Valves shall automatically stop gas flow when actuated by earth tremor and shall be single seated with manual reset. Do not provide manual shut-off attachments.
 - 1. Valve shall comply with ASCE 25 and automatically shut bubble tight within five seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of 0.3 gravity with a period of 0.4 seconds. The valve shall not shut-off when subjected for five seconds to horizontal, sinusoidal oscillations having a peak acceleration of 0.4 gravity with a period of 0.1 second: a peak acceleration of 0.08 gravity with a period of 0.4 second or 1.0 second.
 - 2. Valve should be rated for 125 psi 850 kPa) with flanged ends for pipe sizes above 2 inches (50 mm). Valves should have threaded ends for pipe sizes 2 inches (50 mm) and under.
 - 3. Approvals: UL listed, State of California Standards for Earthquake Actuated Automatic Gas Shut-Off Systems.

2.7 Valve Boxes

- A. Provide cast iron extension box with screw or slide type adjustment and flared base. Minimum thickness of metal, 3/16 inch (5 mm). Box shall be of such length as can be adapted, without full extension, to depth of cover required over pipe at valve location with the word "GAS" in cover.
- B. Provide "T" handle socket wrenches of 5/8 inch (16 mm) round stock long enough to extend 2 feet (600 mm) above top of deepest valve box.

2.8 Pressure Regulators

- A. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for users. Ferrous bodies. Regulators should be:

1. Single stage and suitable for natural-gas, having a steel jacket and corrosion-resistant components and elevation compensator. End Connections should be threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
- B. Service Pressure Regulators shall comply with ANSI Z21.80a/CSA 6.22a, with a maximum inlet pressure of 100 psi (690 kPa) Insert pressure.
- C. Line Pressure Regulators shall comply with ANSI Z21.80a/CSA 6.22a with a maximum inlet pressure of 2 psi (13.8 kPa) 5 psi (34.5 kPa) 10 psi (69 kPa).
- D. Appliance Pressure Regulators shall comply with ANSI Z21.18/CSA 6.3 and have a maximum inlet pressure of 1 psi (6.9 kPa) 2 psi (13.8 kPa) 5 psi (34.5 kPa).

2.9 Service Meters

- A. Meters shall comply with Section 25 10 10, ADVANCED UTILITY METERING SYSTEM and ANSI B109.2.
- B. Gas meters shall be furnished and installed by local gas Utility of type approved by local gas Utility as specified herein.
- C. Meters shall be pipe pedestal mounted. Meters shall be provided with over-pressure protection as specified in ASME B31.8 tamper-proof protection frost protection fungus-proof protection.
- D. Diaphragm-Type service meters shall comply with ANSI B109.1 ANSI B109.2 with a maximum inlet pressure of 690 kPa (100 psi).
- E. Rotary-Type service meters shall comply with ANSI B109.3 with a maximum inlet pressure of 100 psi (690 kPa).
- F. Turbine meters shall comply with ASME MFC-4M with a maximum inlet pressure of 100 psi (690 kPa).
- G. Service-Meter Bars shall be malleable- or cast-iron frame for supporting service meter and include offset swivel pipes, meter nuts with O-ring seal, and factory- or field-installed dielectric unions.
 1. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.
- H. Service-Meter bypass fittings shall be ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply, having an integral ball-check bypass valve.

2.10 Dielectric Fittings

- A. Dielectric Unions shall comply with ASSE 1079 and have a pressure rating of 125 psi (860 kPa) minimum at 180 deg F (82 deg C) 150 psi (1035 kPa) 250 psi (1725 kPa).
- B. Dielectric Flanges shall comply with ASSE 1079 and have a pressure rating of 125 psi (860 kPa) minimum at 180 deg F (82 deg C) 150 psi (1035 kPa) 175 psi (1200 kPa) 300 psi (2070 kPa).
- C. Dielectric-Flange insulating kits shall have a pressure rating of 150 psi (1035 kPa).

2.11 Labeling and Identifying

- A. Detectable warning tape shall be acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 Preparation

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.2 METALLIC Piping Installation

- A. Heating trenches, storm and sanitary sewer lines, and water mains shall have right of way.
- B. Warning tape shall be continuously placed 12 inches (300 mm) above buried gas lines.
- C. Main services and main service shut off valves shall have a 24 inch (600 mm) minimum cover or as recommended by local utility.

- D. Service lines shall have an 18 inch (450 mm) minimum cover or as recommended by local utility.
- E. Where indicated, the main shall be concrete-encased sleeved.
- F. Connections between metallic and plastic piping shall be made only outside, underground, and with approved transition fittings.

3.3 Non-Metallic Pipe Installation

- A. Install pipe in trench in accordance with recommendations of the pipe manufacturer. Provide sufficient slack to allow for expansion and contraction.
- B. Joints shall be fusion welds made in accordance with the recommendations of the polyethylene pipe manufacturer. Adhesive joints for fiberglass plastic pipe shall be made in accordance with manufacturer's recommendations.
- C. All offsets in piping shall be made with manufactured fittings. Bending of piping to form offsets shall not be permitted.
- D. Connections between plastic pipe and metal pipe shall be made in accordance with recommendations of the pipe manufacturer.
- E. Copper Tracer Wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 1000 feet (300 m), provide a 5-pound (2.3 kg) magnesium anode attached to the main tracer wire by solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

3.4 Building Service Lines

- A. Before entering building, underground service line shall rise above grade close to building to permit possible gas leaks to vent themselves.
- B. Install gas service lines to point of connection within approximately 5 feet (1500 mm) outside of buildings to which such service is to be connected and make connections thereto. The point of delivery is the meter set assembly service regulator shutoff valve .

- C. Connect service lines to top of mains by two-strap service clamp or coupling socket) welded to main and into which is screwed a street tee and street elbow swing, joint assembly.
- D. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Polyethylene or fiberglass service lines shall not be installed aboveground except as permitted in ANSI B31.8.
- E. Install gas service lines to point of connection within approximately 5 feet (1500 mm) outside of buildings to which such service is to be connected and make connections thereto. The point of delivery is the meter set assembly service regulator shutoff valve.

3.5 Outdoor Piping Installation

- A. Comply with ASTM D2774 NFPA 54 the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches (900 mm) 24 inches (600 mm) Insert value below finished grade. Minimum cover depth is 18 inches (450 mm). Natural-gas piping installed less than 18 inches (450 mm) below finished grade shall be installed in vented containment conduit.
- C. Install fittings for changes in direction and branch connections.
- D. Install pressure gauge upstream and downstream from each service regulator.

3.6 Pipe Sleeves

- A. Pipe shall be continuous through sleeves. Set sleeves in place before concrete is poured. Seal between sleeve/core opening and the pipe with modular mechanical type link seal. All sleeves shall be vented.
- B. Provide sleeves where gas lines pass through retaining walls, foundation walls or floors. Split sleeves may be installed where existing lines pass through new construction.

3.7 Service-Meter Assembly Installation

- A. Install service-meter assemblies aboveground, on concrete bases.
- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.
- G. Install metal bollards to protect meter assemblies.

3.8 Valve Installation

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.
- F. Do not install valves under pavement unless shown on drawings.
- G. Clean valve interior before installation.

3.9 Valve Boxes

- A. Set cover flush with finished grade.
- B. Protect boxes located in roadway against movement by a concrete slab at least 3 feet (900 mm) square by 6 inches (150 mm) deep.
- C. Set other valve boxes with a concrete slab 18 inches (450 mm) by 18 inches (450 mm) by 6 inches (150 mm) deep and set flush with grade.
- D. All exposed portions of valve boxes shall be painted bright yellow.

3.10 Connections

- A. Connect to utility's gas main according to utility's procedures and requirements.

- B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Install tee fitting with capped nipple in bottom to form drip sediment traps. Install as close as practical to inlet of each appliance.

3.11 Labeling and Identifying

- A. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 Concrete Bases

- A. Anchor equipment to concrete base according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inches (450 mm) Insert dimension centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Use 4000 psi (27.5 MPa) Insert value, 28-day, compressive-strength concrete and reinforcement.

3.13 Pipe Cleaning

- A. All pipe sections shall be blown down with 100 psi (690 kPa) air to remove all sand, soil and debris.
- B. Blow down procedure shall be done after system is complete, but before valves are installed.

3.14 Cathodic Protection

- A. Where soil resistivity is less than 4000 ohm-cm or when required by gas utility, Section 26 42 00, CATHODIC PROTECTION is required.

3.15 Demonstration

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.16 Tests

- A. Piping System: Inspection, testing and purging shall be in accordance with NFPA 54 and ASME B31.8. Maximum working pressure will be Insert psi (Insert kPa).
- B. Cathodic Protection System:
 - 1. Testing of Anodes: Prior to connecting anode lead wire to the piping, insert a millimeter in the circuit and measure and record current output of each anode. When maximum current outputs, as set below, for the different sizes of anodes are exceeded, insert nickel chromium resistance wire in the circuit to reduce current output to maximum allowable for a given size anode. Resistance wire connections to anode lead wires shall be accomplished with silver solder and soldered joints wrapped with a minimum of three layers of high dielectric strength electrical tape. Cover with rubber all nickel chromium resistance wire. Maximum allowable current outputs for the different size anodes to allow for design life are as follows:

Weight Bare Anodes	Allowable Current Output
5 lb (2.3 kg) Anode	10 Milliamperes
9 lb (4 kg) Anode	20 Milliamperes
17 lb (7.7 kg) Anode	40 Milliamperes
32 lb (14.5 kg) Anode	75 Milliamperes

2. Final Test: Final test of the cathodic protection system shall include measuring pipe-to-soil potentials over the entire system. Make potential measurements with potentiometer voltmeter minimum internal resistance of 50,000 ohms per volt) and a copper/copper sulfate reference electrode placed at the finished grade level and directly over the pipe. Adequate number of measurements shall be taken over the extent of piping to ensure that a minimum potential value of -0.85 volts exists over all new gas piping. Upon completion of testing, a report setting forth potential values acquired by location shall be submitted to the Government.

3.17 Outdoor Piping Schedule

- A. Underground natural-gas piping shall be one of the following:
 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
 3. Annealed Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Containment conduit shall be steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.18 Underground Manual Gas Shutoff Valve Schedule

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 1. PE valves.
 2. NPS 2 (DN 50) and smaller use bronze plug valves.
 3. NPS 2-1/2 (DN 65) and larger use Cast-iron, lubricated nonlubricated plug valves.

3.19 Aboveground Manual Gas Shutoff Valve Schedule

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full regular -port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
 - 1. Two-piece, full regular-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full regular -port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - 1. Two-piece, full regular -or regular -ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, nonlubricated lubricated plug valve.
- E. Lubricated plug piping for single appliance shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full regular-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.

--- E N D ---

SECTION 34 71 13
PASSIVE VEHICLE BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stationary anti-ram rated vehicle barriers protecting above ground equipment.

1.2 RELATED REQUIREMENTS

- A. Concrete Site Walls, Islands, and Curbs: Section 03 30 00, CAST-IN-PLACE CONCRETE Section 03 30 53, (SHORT FORM) CAST-IN-PLACE CONCRETE.
- B. Masonry Site Walls: Section 04 20 00, UNIT MASONRY.
- C. Pipe Bollards: Section 05 50 00, METAL FABRICATIONS.
- D. Concrete Driveway and Approach Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- E. Asphalt Driveway and Approach Paving: Section 32 12 16, ASPHALT PAVING.
- F. Perimeter Security Fences: Section 32 31 53, PERIMETER SECURITY FENCES AND GATES.
- G. Deployable Vehicle Barriers: Section 34 75 13.13, ACTIVE VEHICLE BARRIERS.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to the extent specified in this section.
- B. ASTM International (ASTM):
 1. F2656/F2656M-15 - Crash Testing of Vehicle Security Barriers.
- C. United States Department of State (DS):
 1. SD-STD02.01-Revision A - Vehicle Crash Testing of Perimeter Barriers and Gates.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 1. Show size, configuration, fabrication and installation details.
 2. Show dimensions and clearances between barriers and other adjacent permanent construction.
 3. Include setting drawings and templates for anchors, sleeves, and other items embedded into concrete foundations.

- C. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

- 1. Test mockups verifying compliance with specified performance.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify field conditions affecting vehicle barrier installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Structural Vehicle Barriers:
 - 1. Bollards: Steel pipe, concrete filled. See Section 05 50 00, METAL FABRICATIONS.

2.2 SYSTEM PERFORMANCE

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify foundation suitability for product installation.
- B. Coordinate delivery and installation of anchors, sleeves, and other items embedded in concrete foundations.
- C. Coordinate barrier system layout and installation with vehicle control facilities including:
 - 1. Driveway and approach paving. See Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS Section 32 12 16, ASPHALT PAVING.
 - 2. Perimeter security fences. See Section 32 31 53, PERIMETER SECURITY FENCES AND GATES.
 - 3. Deployable vehicle barriers. See Section 34 75 13.13, ACTIVE VEHICLE BARRIERS.

VA Atlanta TVDD 12 Bed CLC
Contract #36C77622R0059
Carrollton GA 30117

Project #508-349

04-01-18

3.2 INSTALLATION

1. Site Wall Installation: See Section 03 30 00, CAST-IN-PLACE CONCRETE
Section 03 30 53, (SHORT FORM) CAST-IN-PLACE CONCRETE Section
04 20 00, UNIT MASONRY .
2. Bollard Installation: See Section 05 50 00, METAL FABRICATIONS.

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Geotechnical Engineering Report

Trinka Davis VA - Community Living Centers
Carrollton, Georgia

June 16, 2023

Terracon Project No. 49235016

Prepared for:

Guidon Design, Inc.
Indianapolis, IN

Prepared by:

Terracon Consultants, Inc.
Atlanta, Georgia



June 16, 2023

Guidon Design, Inc.
1221 N. Pennsylvania Street
Indianapolis, IN 30328



Attn: Mr. Mark Jones – Senior Project Manager + Director
E: mjones@guidondesign.com

Re: Geotechnical Engineering Report
Trinka Davis VA - Community Living Centers
108 Martin Drive
Carrollton, Georgia
Terracon Project No. 49235016

Dear Mr. Jones:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P49225016, dated January 26, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

A handwritten signature in black ink, appearing to read "Kevin L. Privette".

Kevin L. Privette, P.E.
Senior Engineer



A handwritten signature in black ink, appearing to read "William J. Sheffield".

William J. Sheffield, P.E.
Manager | Geotechnical Services



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Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

- EXPLORATION AND TESTING PROCEDURES
- SITE LOCATION AND EXPLORATION PLANS
- EXPLORATION RESULTS
- SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report
Trinka Davis VA - Community Living Centers
108 Martin Drive
Carrollton, Georgia
Terracon Project No. 49235016
June 16, 2023

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed small home addition to be located at 108 Martin Drive in Carrollton, Georgia. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Demolition considerations
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures

The geotechnical engineering Scope of Services for this project included the advancement of 5 supplemental test borings to a depth of 25 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of readily available geologic and topographic maps as well as provided documents, plans, etc.

Item	Description
Parcel Information	The project is located on a 0.34-acre area at 108 Martin Drive in Carrollton, Georgia. Approximate Coordinates: 33.590351°N / -85.058860°W See Site Location

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Trinka Davis VA - Community Living Centers ■ Carrollton, Georgia

June 16, 2023 ■ Terracon Project No. 49235016



Item	Description
Existing Improvements	The area currently consists of a concrete paved access drive with some parking stalls along the north side of the site. An existing building is to the south and east of the southern end of the site. Based on historical aerial photographs the site was developed between 2010 and 2012.
Current Ground Cover	Concrete pavements with grassed perimeters and some trees.
Existing Topography	The site is relatively flat, with a slight downward slope to the west and in the northwest corner of the area.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. Our current understanding of the project conditions is as follows:

Item	Description
Information Provided	Our understanding of the project is based upon email correspondence and a telephone conversation with you. The following files were provided via email: ■ 16.1043 – 16.10.11 – Subagreement Terracon – executed.pdf ■ Attachment 1 – 508 – 349 A E SOW.pdf ■ P.1795 – Trinka Davis VA Clinic – Survey area.pdf Terracon is familiar with the site having performed a geotechnical exploration for the existing parking deck in 2016 - Terracon Project No. 49165249.
Project Description	We understand that the project consists of a 15-bed small home addition.
Proposed Structure	The project includes a one story (approximately 14,500 SF) building. A covered walkway will connect the southeast corner of the new structure with the existing adjacent building.
Building Construction	The structure will have either a reinforced concrete or steel frame with a concrete slab-on-grade
Finished Floor Elevation	Will match that of the existing building.
Maximum Loads (assumed)	■ Columns: 150 kips ■ Walls: 4 kips per linear foot (klf) ■ Slabs: 100 pounds per square foot (psf)
Grading/Slopes	For the purposes of this report, we have assumed maximum cuts and fills on the order of 5 feet will be needed to establish finished grades.
Below-Grade Structures	None anticipated (basements, underground detention, etc.)
Free-Standing Retaining Walls	None anticipated but may become necessary as design progresses.
Pavements	No new pavements are anticipated. The site plan indicates the existing access drive will be converted to a circular turn around to the east of the new structure. If needed, we have provided our standard pavement design recommendations assuming 50 automobiles per day and 2 times per week delivery truck.

GEOTECHNICAL CHARACTERIZATION

Site Geology

The project site is located in the Piedmont Physiographic Province of Georgia which is characterized by medium to high grade metamorphic rocks and scattered igneous intrusions. The term metamorphic describes rocks that have been subjected to high temperatures and/or pressures, usually deep within the earth's crust. These high temperatures and pressures cause the textural and mineralogical characteristics of the original rock to be altered and can also cause certain rock types to fully melt, becoming what is known as magma. Magma is less dense than the surrounding solidified rock and tends to move upward through fractures and joints, displacing the surrounding rock. This rock type is known as an igneous intrusion. Metamorphic rocks are predominant in this region but, due to erosion and uplift, both of these rocks will eventually become exposed at the land surface.

The subsurface bedrock in this region has undergone differing rates of weathering, which often produces a considerable variation in depth to competent rock over short horizontal distances. It is also not unusual for lenses and boulders of hard rock and zones of partially weathered rock to be present within the soil mantle above the general bedrock level. The typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands, which often consist of saprolites (native soils which maintain the original fabric of the parent rock). Generally, the soil becomes harder with depth to the top of parent crystalline rock or "massive bedrock" which occurs at depth.

The boundary between soil and rock is typically not sharply defined. A transitional zone termed "partially weathered rock" is normally found overlying bedrock. Partially weathered rock (PWR) is defined for engineering purposes as residual material with a standard penetration resistance exceeding 100 blows per foot (bpf).

Based on published geologic mapping the, the site is underlain by Piedmont Province soils derived from granitic gneiss.

Fill soils are those soils that have been placed or reworked by man in conjunction with past construction grading, underground utility installation, farming or other previous activity at the site. Fill can be composed of different soil types from various sources and can contain debris from building demolition, organics, topsoil, trash, etc. The engineering properties of the fill depend primarily on its composition, density, and moisture content. Some materials, where it is difficult to determine if they are fill, are deemed as possible fill.

Typical Subsurface Profile

The borings drilled at the site generally encountered topsoil, existing fill materials, and residual soils.

All borings encountered existing fill to depths ranging from about 3 to 6 feet. The fill appears to have been placed in a controlled manner, but we have no records to indicate the degree of compaction achieved during placement. If records are available, they should be provided to Terracon for use in our evaluation and development of geotechnical recommendations.

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Stratum 1	1/2 to 1 inches	Topsoil	
Stratum 2	3 to 6 feet	Fill – Silty SAND	Loose to Medium Dense
Stratum 3	To boring termination of 25 feet	Residuum – Sandy Silt (MH) Silty Sand (SM)	Soft to Medium Stiff Loose to Medium Dense

As part of the laboratory tests, 11 moisture content, 2 Atterberg limits, and 2 grain size analysis were conducted on selected soil samples. The test results are presented in the **Exploration Results** section of this report.

Briefly, the moisture content of representative soil samples ranged from 14% to 36%. The results of the Atterberg limits and grain size analysis are summarized in the following tables.

Atterberg Limits				
Boring	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index
B-1	3.5-5	66	40	26
B-4	6-7.5	52	33	19

Geotechnical Engineering Report

Trinka Davis VA - Community Living Centers ■ Carrollton, Georgia

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Grain Size Analysis			
Boring	Depth (feet)	Sand (Percentage)	Fines (Percentage)
B-1	1-2.5	58.4	41.6
B-4	1-2.5	50.1	49.9

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each of the borings are presented on the boring logs included in the **Exploration Results** section of this report.

Groundwater

The boreholes were observed while drilling and shortly after completion for the presence and level of groundwater. The water levels observed in the boreholes are noted on the attached boring logs, and are summarized below:

Boring Number	Depth to groundwater while drilling (Feet/inches)
B-1	14/3
B-2	14/9
B-3	15/6
B-4	16/7
B-5	16/3

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil or rock strata. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, we recommend that the proposed structure be supported on a spread footing foundation system as discussed herein.

Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

The **Shallow Foundations** section addresses support of the building bearing on native stiff to hard lean/fat clay or engineered fill. The **Floor Slabs** section addresses slab-on-grade support of the building.

Support of foundations, floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risk associated with building over the undocumented fills following the recommended reworking of the material. Should this be the case, development can be supported on a shallow foundation system.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of data presented herein, engineering analyses, and our current understanding of the proposed project.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include demolition of the existing asphalt pavements, clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in preparation of specifications. Recommendations include quality criteria necessary, to appropriately prepare the site.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project and identified in this report.

Site Preparation

We anticipate construction will be initiated by stripping vegetation, and loose, soft or otherwise unsuitable material. Stripped materials consisting of vegetation and organic materials should be wasted off site or used to vegetate landscaped areas or exposed slopes after completion of grading operations. Stripping depths between our boring locations and across the site could vary considerably; as such we recommend actual stripping depths be evaluated by Terracon during construction to aid in preventing removal of excess material. Existing pavements, and / or underground utilities should be removed and replaced with engineered fill.

The fine-grained soils encountered in the borings will be sensitive to disturbance from construction activity and water seepage. If precipitation occurs prior to or during construction, the near-surface soils could increase in moisture content and become more susceptible to disturbance. Construction activity should be monitored and curtailed if the construction activity is causing subgrade disturbance. Terracon can help with monitoring and developing recommendations to aid in limiting subgrade disturbance.

After stripping, proofrolling should be performed with heavy rubber tire construction equipment such as a fully loaded tandem-axle dump truck. A Terracon geotechnical engineer or his representative should observe proofrolling to aid in locating unstable subgrade materials. Proofrolling should be performed after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade and to reduce the amount of undercutting / remedial work required. Unstable materials identified should be stabilized as directed by the engineer based on conditions observed during construction. Undercut and replacement and densification in-place are typical remediation methods.

Existing Fill

As noted in **Geotechnical Characterization**, all borings encountered existing fill to depths ranging from about 3 to 6 feet. The fill appears to have been placed in a controlled manner, but we have no records to indicate the degree of compaction achieved during placement. If such records (density test, etc.) exist, they should be provided to us for evaluation.

Support of footings, floor slabs, and pavements, on or above existing fill soils, is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

If the owner elects to construct the footings and floor slabs on the existing fill, the following protocol should be followed. All foundation bearing soils should be evaluated prior to concrete placement. Once the planned grading has been completed, the entire area should be proofrolled with heavy, rubber tire construction equipment, to aid in delineating areas of soft or otherwise unsuitable soil.

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Once unsuitable materials have been remediated, and the subgrade has passed a proofroll, the existing and undocumented fill that was removed can be evaluated for reuse as structural fill.

Excavation Conditions

After comparison of the boring data and the anticipated finished grade elevations, we do not anticipate that materials requiring difficult excavation techniques for removal will be encountered during mass grading operations or utility trench installation. The existing fill and residual soils found above finished floor levels should be excavatable with conventional earthmoving equipment.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or slopes. General fill is material used to achieve grade outside of these areas. Soils used for structural and general fill should meet the following material property requirements:

Soil Type ^{1,3,4}	USCS Classification	Acceptable Parameters (for Structural Fill)
Fine Grain	CL and ML LL < 45 / PI < 25	All Locations and Elevations
Granular	SP, SM, SC, and SW	All Locations and Elevations
On-Site Soils ²	SM, MH	All Locations and Elevations

1. Structural and general fill should consist of materials relatively free of organic matter, debris, and particles larger than about 4 inches. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. A large portion of the existing fill is expected to be suitable for reuse as new fill provided it is free of organics, debris, and unsuitable materials. It appears the fill is wet and will require drying prior to use. Terracon should field evaluate existing fill materials for use.
3. All fill should have a maximum dry density of at least 95 pounds per cubic foot (pcf) as determined by the standard Proctor test (ASTM D 698).
4. Any materials proposed as fill from off-site sources should be tested for compliance with these criteria before being hauled to the site.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as Structural fill
Minimum Compaction Requirements ^{1,2}	98% of max. dry density within 1 foot of floor slabs or finished pavement subgrade 95% of max. dry density below foundations and more than 1 foot below floor slabs or finished pavement subgrade	92% of max.
Moisture Content Range ^{1,2,3}	Fine Grain Soils: -2% to +3% of optimum Granular: -2% to +3% of optimum	As required to achieve min. compaction requirements
- Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698). - Fill should be tested for compaction and moisture content during placement. Should the results of the in-place density tests indicate that the specified moisture or compaction requirements have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. - Moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without pumping when proofrolled. Based on laboratory testing portions of the soils were wet of their optimum moisture content. Therefore, some moisture conditioning should be expected prior to or during fill placement.		

Grading and Drainage

Adequate positive drainage should be provided during construction and maintained throughout the life of the development to prevent an increase in moisture content of the foundation, pavement and backfill materials. Surface water drainage should be controlled to prevent undermining of fill slopes and structures during and after construction.

Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended.

It is recommended that all exposed earth slopes be seeded to provide protection against erosion as soon as possible after completion. Seeded slopes should be protected until the vegetation is established. Sprinkler systems should not be installed behind or in front of walls or near slopes.

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

Surface water should not be allowed to pond on the site and soak into the soil during construction. Construction staging should provide drainage of surface water and precipitation away from the building and pavement areas. Any water that collects over or adjacent to construction areas should be promptly removed, along with any softened or disturbed soils. Surface water control in the form of sloping surfaces, drainage ditches and trenches, and sump pits and pumps will be important to avoid ponding and associated delays due to precipitation and seepage.

Groundwater was encountered in all of the borings during our exploration. Based on our understanding of the proposed development, we do not expect groundwater to affect construction. If groundwater is encountered during construction, some form of temporary or permanent dewatering may be required. Conventional dewatering methods, such as pumping from sumps, should likely be adequate for temporary removal of any groundwater encountered during excavation at the site. Well points would likely be required for significant groundwater flow, or where excavations penetrate groundwater.

All excavations should be sloped or braced as required by Occupational Safety and Health Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork operations should be observed by the Geotechnical Engineer or his representative. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of unstable areas delineated by the proofroll. Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer or his representative prior to placement of additional lifts. Any areas that do not meet the compaction specifications should be reworked to achieve compliance.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer or his representative. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in the **Earthwork** section, the proposed structure can be supported by a shallow, spread footing foundation system bearing on residual soils or structural fill extending to residual soils. Design recommendations for shallow foundations for the proposed structure are presented in the following paragraphs.

Shallow foundations may be supported on existing fill soils provided the site has been prepared in accordance with the requirements noted in the **Earthwork** section. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report. Design recommendations for shallow foundations for the proposed structure are presented in the following paragraphs.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing pressure ^{1, 2}	3,000 psf
Required Bearing Stratum ³	Structural fill or residual soils.
Minimum Foundation Dimensions	Columns: 24 inches Continuous: 16 inches
Ultimate Passive Resistance ⁴ (equivalent fluid pressures)	160 psf
Ultimate Coefficient of Sliding Friction ⁵	0.35

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Item	Description
Minimum Embedment below Finished Grade ⁶	Exterior footings in unheated areas: 18 inches Exterior footings in heated areas: 18 inches Interior footings in heated areas: 12 inches
Estimated Total Settlement from Structural Loads ²	Less than about 1 inch
Estimated Differential Settlement ^{2, 7}	About ½ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 5% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. For passive earth pressure to develop, the footing must move horizontally to mobilize resistance. Therefore, the total calculated passive pressure should be reduced by one-half to two-thirds for design purposes.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are as measured over a span of 40 feet.

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The weight of the foundation concrete below grade may be neglected in dead load computations. Interior footings should bear a minimum of 12 inches below finished grade. Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

Footings, foundations, and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ from those presented in this report, supplemental recommendations will be required.

Design Parameters - Uplift Loads

We understand a covered walkway will connect the southeastern corner of the new structure to the existing structure. Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated in the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of

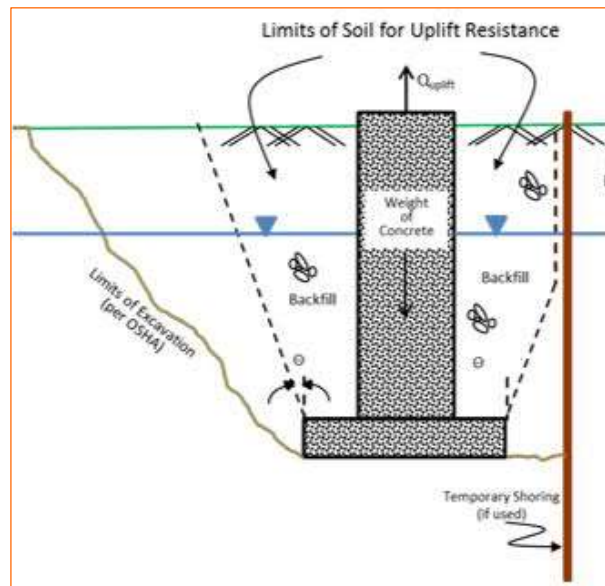
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the foundation to the ground surface at an angle, θ , of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 120 pcf should be used for the backfill. This unit weight should be reduced to 50 pcf for portions of the backfill or natural soils below the groundwater elevation.



Foundation Construction Considerations

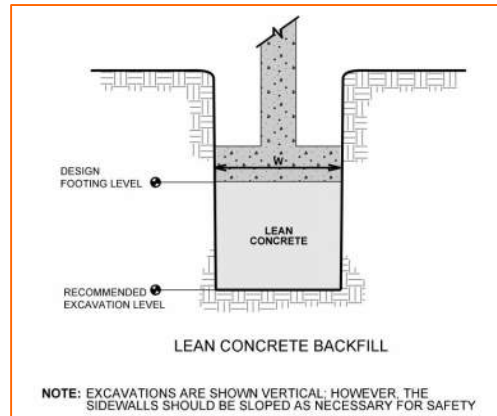
As noted in the **Earthwork** section, soils exposed in footing excavations should be evaluated by the Geotechnical Engineer or his representative. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, or frozen, the affected soil should be removed prior to placing concrete. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.

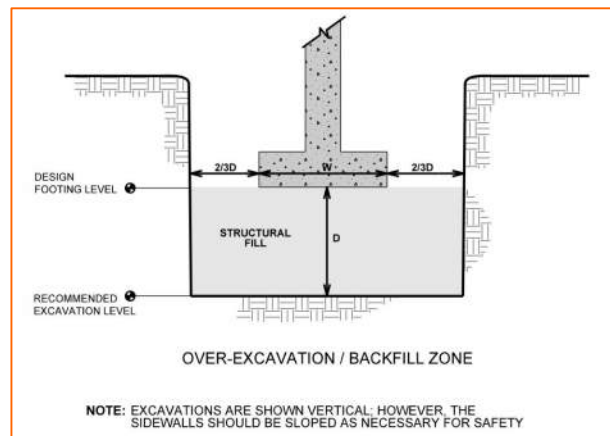
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Over-excavation for structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with well-graded granular material placed in lifts of 8 inches or less in loose thickness and compacted to at least 95 percent of the material's maximum standard Proctor dry density (ASTM D-698). The overexcavation and backfill procedure is described in the figure below.



For foundations adjacent to slopes, a minimum horizontal setback of 10 feet should be maintained between the foundation base and slope face. In addition, the setback should be at a location where an imaginary line extending downward at 45 degrees from the nearest edge of the foundation does not intersect the slope face.

Areas of loose soils may be encountered at foundation bearing depth after excavation is completed for footings. When such conditions exist beneath planned footing areas, the subgrade soils should be surficially compacted prior to placement of the foundation system. If sufficient compaction cannot be achieved in-place, the loose soils should be removed and replaced with

engineered fill. For placement of engineered fill below footings, the excavation should be widened laterally, at least eight inches for each foot of fill placed below footing base elevations.

SEISMIC CONSIDERATIONS

Seismic Site Classification

Code Used	Site Classification
2018 International Building Code (IBC) ¹	D ²

1. In general accordance with the 2018 International Building Code.
2. The 2018 International Building Code (IBC) requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100-foot soil profile determination. Borings for the building extended to a maximum depth of approximately 20 feet and this seismic site class definition considers that medium dense silty sand continues below the maximum depth of the subsurface exploration. Additional exploration to deeper depths could be performed to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a higher seismic site class.

FLOOR SLABS

Depending upon the finished floor elevation, unsuitable, weak, soft to medium stiff soils may be encountered at the floor slab subgrade level. These soils should be replaced with structural fill so the floor slab is supported on at least 2 feet of compacted suitable natural soils or structural fill.

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Interior floor system	Slab-on-grade concrete.
Floor Slab Support ¹	Minimum 12 inches of approved on-site or imported soils placed and compacted in accordance with the Earthwork section of this report. ^{2,3}
Subbase ³	4-inch compacted layer of free draining, granular subbase material

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. We recommend subgrades be maintained at the proper moisture condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction, the affected material should be removed or the materials scarified, moistened, and recompact. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
3. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material, at least 4 inches thick.

A subgrade prepared and tested as recommended in this report should provide adequate support for lightly loaded floor slabs.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base rock and concrete and corrective action may be required.

We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and placement of base rock. Attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the base rock and concrete.

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

LATERAL EARTH PRESSURES

Design Parameters

The lateral earth pressure recommendations herein are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls. Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop recommendations for the design of such wall systems upon request.

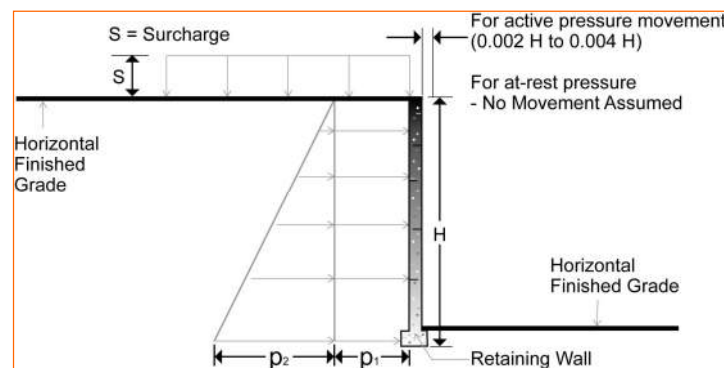
Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint

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conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The “at-rest” condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters			
Earth Pressure Condition	Coefficient for Backfill Type ⁴	Surcharge Pressure p_1 (psf) ^{5,6,7}	Effective Fluid Pressure p_2 (psf) ^{4,6,7,8,9}
Active (K_a) ¹	Sandy Silt/Silty Sand- 0.36	$(0.36)S$	$(45)H$
At-Rest (K_o)	Sandy Silt/Silty Sand - 0.53	$(0.53)S$	$(65)H$
Passive (K_p) ^{2,3}	Sandy Silt/Silty Sand – 2.8	---	---

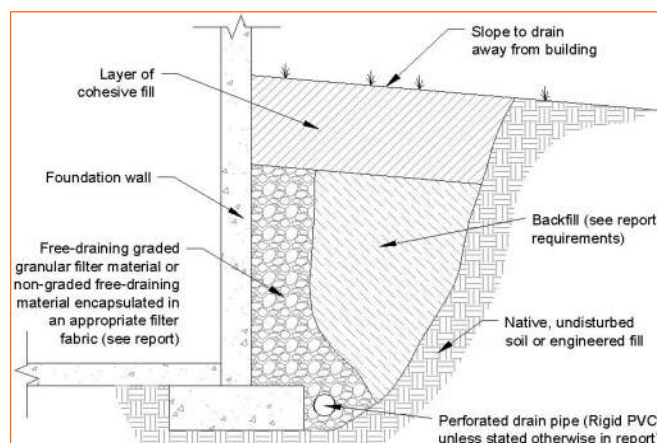
1. For active earth pressure, wall must rotate about base, with top lateral movements $0.002 H$ to $0.004 H$, where H is wall height.
2. For passive earth pressure to develop, wall must move horizontally to mobilize resistance. Therefore, the total calculated passive pressure should be reduced by one-half to two-thirds for design purposes.
3. Ignore passive pressure in frost zone
4. Uniform, horizontal backfill, compacted to at least 95% of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf.
5. Uniform surcharge, where S is surcharge pressure.
6. Loading from heavy compaction equipment and dynamic loading are not included.
7. No safety factor is included in these values.
8. To achieve “Unsaturated” conditions, follow guidelines in Subsurface Drainage for Below-Grade Walls below.
9. No hydrostatic pressure acting on wall.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. To calculate the resistance to sliding, a value of 0.35 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

PAVEMENTS

Subgrade Preparation

On most project sites, the site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the pavement subgrades be proofrolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

After proofrolling and repairing subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in the **Earthwork** section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning.

Pavement Design Considerations

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g., garden centers, wash racks);
- Install joint sealant and seal cracks immediately;

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- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils;
- Place compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Place curb, gutter and/or sidewalk directly on low permeability subgrade soils rather than on unbound granular base course materials.

Estimates of Minimum Pavement Thickness

As a minimum, we recommend the following typical pavement sections be considered. We have assumed 50 automobiles per day and a delivery truck 2 times per week.

Asphalt (AC) Pavement			
Material	Light Duty ¹ Thickness (inches)	Heavy Duty ² Thickness (inches)	GDOT
Subgrade	Upper 12 inches of existing soil or engineered fill	Upper 12 inches of existing soil or engineered fill	98% of Standard Proctor MMD, -2 to +3% OMC
Aggregate Base	6	8	GAB, Section 815 and 310
Asphalt Binder Course	-	1¾	SP19 - Section 400, 424, 824 and 828
Asphalt Surface Course	2	1¾	SP9.5 - Section 400, 424, 824 and 828

1. Automobiles only.

2. Combined automobiles and trucks.

The graded aggregate base should be compacted to a minimum of 98 percent of the material's modified Proctor (ASTM D-1557, Method C) maximum dry density. Where base course thickness exceeds 6 inches, the material should be placed and compacted in two or more lifts of equal thickness.

The listed pavement component thicknesses should be used as a guide for pavement systems at the site for the traffic classifications stated herein. These recommendations assume a 20-year pavement design life. If pavement frequencies or loads will be different than that specified Terracon should be contacted and allowed to review these pavement sections.

Asphalt concrete aggregates and base course materials should conform to the Georgia Department of Transportation (GDOT) "Standard Specifications for Construction of Transportation System".

Portland Cement Concrete (PCC) Pavement			
Material	Light Duty ¹ Thickness (inches)	Heavy Duty ² Thickness (inches)	Reference
Subgrade	Upper 12 inches of existing soil or engineered fill	Upper 12 inches of existing soil or engineered fill	GDOT: 98% of Standard Proctor MMD, -2 to +3% OMC
Aggregate Base	4	4	GDOT: GAB, Section 815 and 310
PCC	5	6 ½	ACI

1. Automobiles only.

2. Combined automobiles and trucks.

We recommend a Portland cement concrete (PCC) pavement be utilized in entrance and exit sections, dumpster pads, loading dock areas, or other areas where extensive wheel maneuvering are expected. The dumpster pad should be large enough to support the wheels of the truck which will bear the load of the dumpster.

Although not required for structural support, the base course layer is recommended to help reduce potentials for slab curl, shrinkage cracking, and subgrade “pumping” through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Portland cement concrete should be designed with proper air-entrainment and have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing. Adequate reinforcement and number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI requirements. The joints should be sealed as soon as possible (in accordance with sealant manufacturer’s instructions and ACI requirements) to minimize infiltration of water into the soil.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

We recommend drainage be included at the bottom of the GAB layer at the storm structures to aid in removing water that may enter this layer. Drainage could consist of small diameter weep holes excavated around the perimeter of the storm structures. The weep holes should be

excavated at the elevation of the GAB and soil interface. The excavation should be covered with No. 57 stone which is encompassed in Mirafi 140 NL or approve equivalent which will aid in reducing fines from entering the storm system.

Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria, etc.) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for

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third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either substantiate or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
5	25	building / utilities

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit. No existing ground surface elevations were provided, and none are shown on the boring logs. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: We advanced the borings with an ATV-mounted rotary drill rig using continuous flight hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Geotechnical Engineering Report

Trinka Davis VA - Community Living Centers ■ Carrollton, Georgia

June 16, 2023 ■ Terracon Project No. 49235016



Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to further evaluate the engineering properties of the various soil strata, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan

Exploration Plan

Note: All attachments are one page unless noted above.

SITE LOCATION

Trinka Davis VA - Community Living Centers ■ Carrollton, Georgia
June 16, 2023 ■ Terracon Project No. 49235016

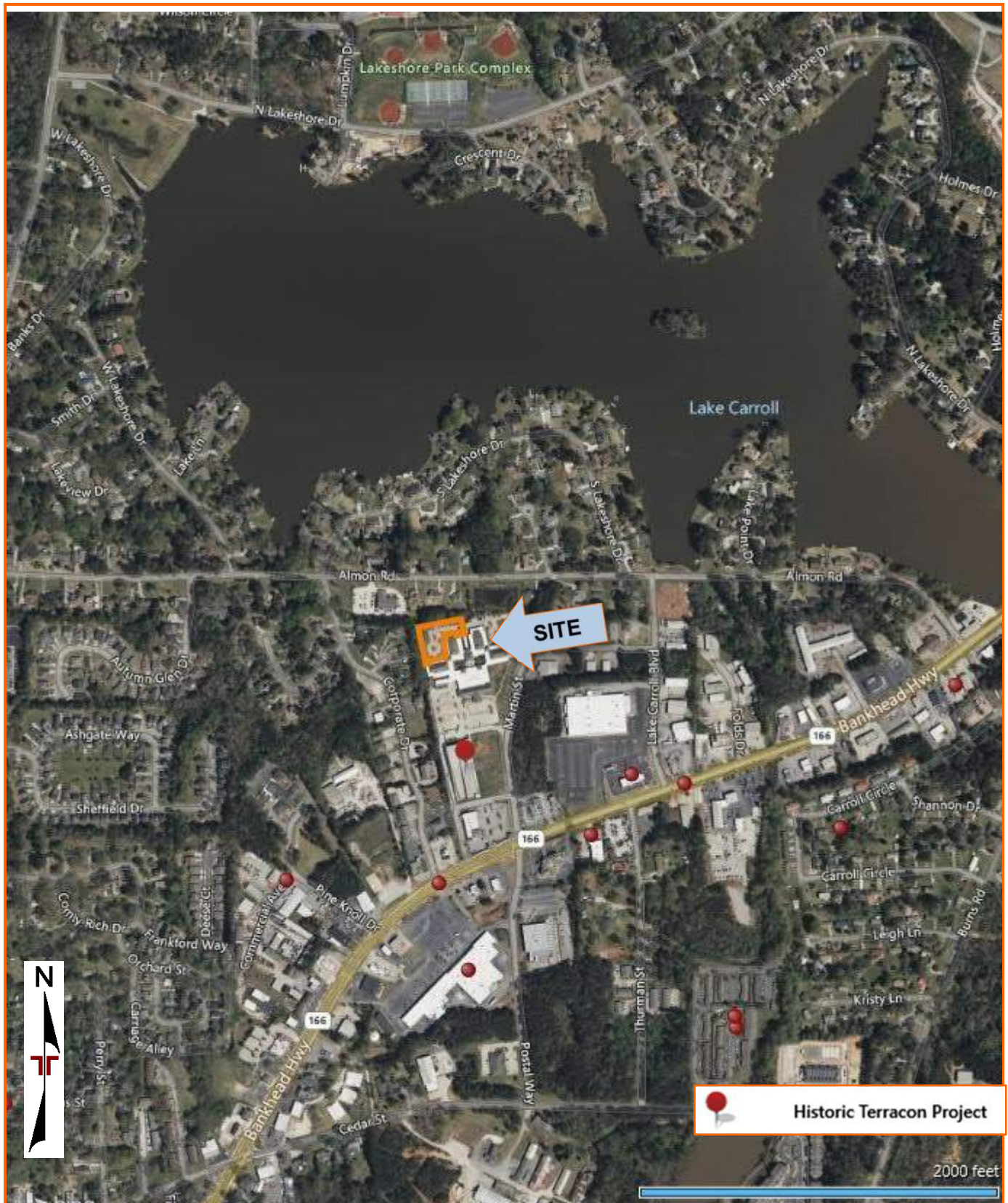


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Trinka Davis VA - Community Living Centers ■ Carrollton, Georgia
June 16, 2023 ■ Terracon Project No. 49235016

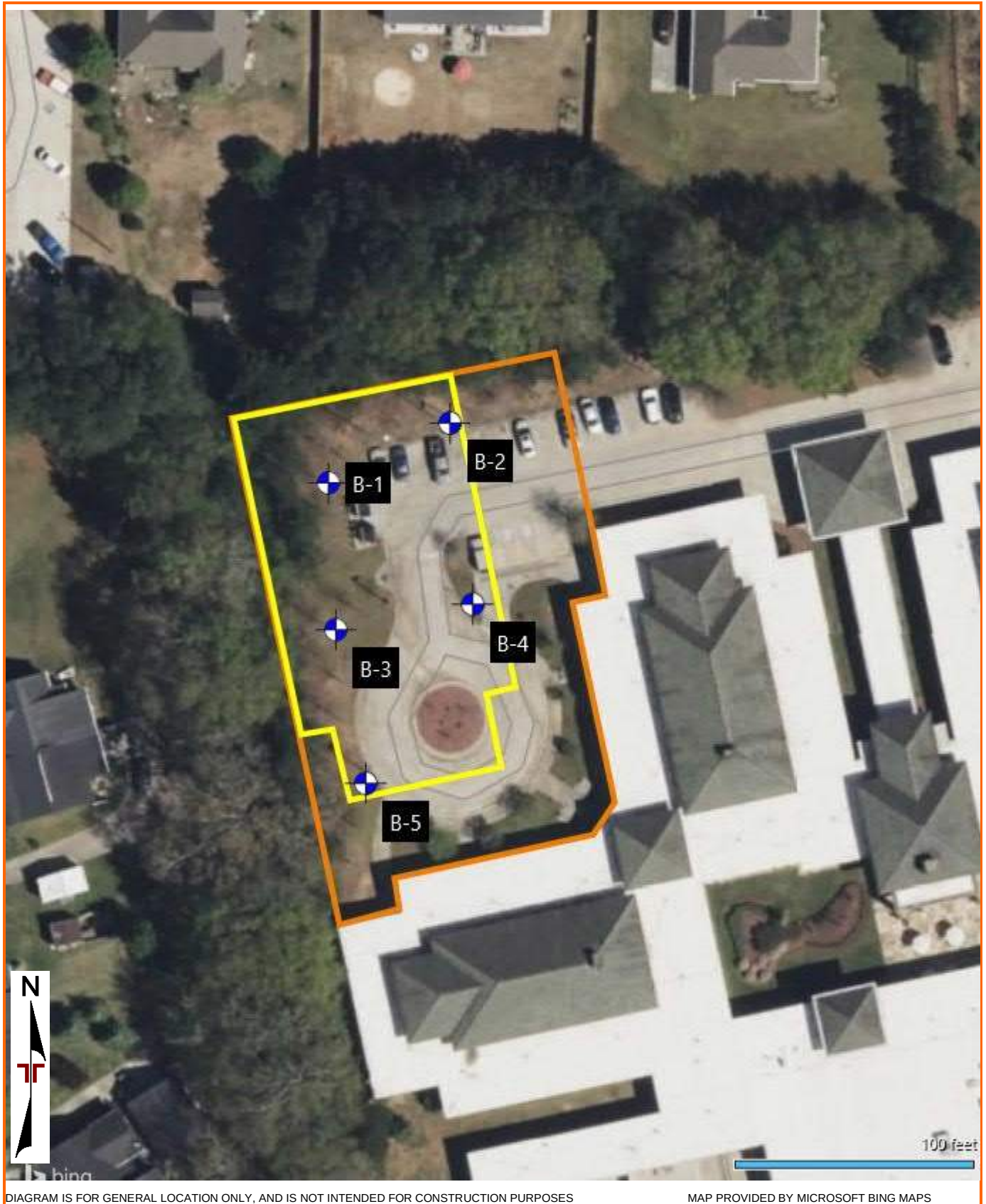


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through B-5)

Atterberg Limits

Grain Size Distribution

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

Page 1 of 1

PROJECT: Trinka Davis VA - Community Living Centers

CLIENT: Guidon Design, Inc.
Indianapolis, IN

SITE: 180 Main Street
Carrollton, GA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.5905° Longitude: -85.0589°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	DEPTH					
	0.0 TOPSOIL , 1/2 Inch					
	FILL - SANDY SILT (SM) , with rock fragments, orange-brown, loose			X	4-4-4 N=8	13.8
	3.0					
	RESIDUUM - SANDY SILT (MH) , orange, stiff			X	3-5-7 N=12	36.5
		5				
				X	4-4-6 N=10	
	- soft					
		10		X	1-1-2 N=3	
	- medium stiff					
		15		X	2-3-2 N=5	
	18.0					
	SILTY SAND (SM) , fine to medium grained, orange-black, medium dense			X	6-8-9 N=17	
		20				
				X		
	25.0					
	Boring Terminated at 25 Feet	25				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Notes:

Abandonment Method:
Backfilled with soil cuttings

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

14 Feet 3 Inches While Drilling

Boring Started: 06-02-2023

Boring Completed: 06-02-2023

Drill Rig: CME 550

Driller: MDS Midway - Casey

Project No.: 49235016

Cave In At 17 Feet 6 Inches

Terracon
2105 Newpoint Pl, Ste 600
Lawrenceville, GA

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_49235016 TRINKA DAVIS VA - GPJ TERRACON_DATATEMPLATE.GDT 6/15/23

BORING LOG NO. B-2

Page 1 of 1

PROJECT: Trinka Davis VA - Community Living Centers

CLIENT: Guidon Design, Inc.
Indianapolis, IN

SITE: 180 Main Street
Carrollton, GA

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_49235016 TRINKA DAVIS VA - GPJ TERRACON_DATATEMPLATE.GDT 6/15/23

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.5906° Longitude: -85.0587°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	DEPTH					
0.0	TOPSOIL , 1/2 Inch					
	FILL - SILTY SAND (SM) , trace organics, red, loose			X	3-4-3 N=7	21.4
	- trace rock fragments, medium dense			X	4-5-5 N=10	15.7
6.0	RESIDUUM - SANDY SILT (MH) , orange, stiff			X	4-6-7 N=13	
	- medium stiff			X	2-2-4 N=6	
	- soft			X	1-2-1 N=3	
18.0	SILTY SAND (SM) , trace rock fragments, fine to medium grained, pink, medium dense			X	3-4-6 N=10	
	- orange-black			X	6-9-10 N=19	
25.0	Boring Terminated at 25 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger	See Supporting Information for explanation of symbols and abbreviations.	Notes:	
Abandonment Method: Backfilled with soil cuttings			
WATER LEVEL OBSERVATIONS		Boring Started: 06-02-2023	Boring Completed: 06-02-2023
 14 Feet 9 Inches While Drilling		Drill Rig: CME 550	Driller: MDS Midway - Casey
 Cave In At 19 Feet 7 Inches		Project No.: 49235016	

Terracon
2105 Newpoint Pl, Ste 600
Lawrenceville, GA

BORING LOG NO. B-3

Page 1 of 1

PROJECT: Trinka Davis VA - Community Living Centers

CLIENT: Guidon Design, Inc.
Indianapolis, IN

SITE: 180 Main Street
Carrollton, GA

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 49235016 TRINKA DAVIS VA - GPJ TERRACON_DATATEMPLATE.GDT 6/15/23

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.5904° Longitude: -85.0589°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	DEPTH					
0.1	TOPSOIL , 1 Inch					
	FILL - SANDY SILT (ML) , with rock, red-black, stiff			X	3-6-5 N=11	18.2
6.0		5		X	4-4-5 N=9	25.7
	RESIDUUM - SANDY SILT (MH) , trace mica, red, stiff			X	5-7-8 N=15	
13.0		10		X	3-5-6 N=11	
	SILTY SAND (SM) , with mica, trace clay, fine to medium grained, tan, loose			X	3-3-4 N=7	
	- orange-black, very loose	15	▽			
	- loose	20		X	1-1-2 N=3	
25.0		25		X	2-3-5 N=8	
	Boring Terminated at 25 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See [Supporting Information](#) for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ 15 Feet 6 Inches While Drilling

⊠ Cave In At 19 Feet 6 Inches

Terracon
2105 Newpoint Pl, Ste 600
Lawrenceville, GA

Boring Started: 06-02-2023

Drill Rig: CME 550

Project No.: 49235016

Boring Completed: 06-02-2023

Driller: MDS Midway - Casey

BORING LOG NO. B-4

Page 1 of 1

PROJECT: Trinka Davis VA - Community Living Centers

CLIENT: Guidon Design, Inc.
Indianapolis, IN

SITE: 180 Main Street
Carrollton, GA

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 49235016 TRINKA DAVIS VA - GPJ TERRACON_DATATEMPLATE.GDT 6/15/23

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.5903° Longitude: -85.0587°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	DEPTH					
	0.0 TOPSOIL , 1/2 Inch					
	FILL - SILTY SAND (SM) , trace organics, red, loose			X	3-3-4 N=7	16.4
	- with rock fragments, medium dense			X	3-4-6 N=10	25.0
	6.0 RESIDUUM - SANDY SILT (MH) , red, very stiff			X	8-11-8 N=19	21.1
	- with mica, stiff			X	6-7-7 N=14	
	13.0 SILTY SAND (SM) , with mica, fine to medium grained, tan, loose			X	2-4-5 N=9	
	- trace rock fragments, orange-black			X	2-3-3 N=6	
	25.0 Boring Terminated at 25 Feet			X	4-4-5 N=9	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See [Supporting Information](#) for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

 16 Feet 7 Inches While Drilling

 Cave In At 21 Feet 6 Inches

Terracon

2105 Newpoint Pl, Ste 600
Lawrenceville, GA

Boring Started: 06-02-2023

Drill Rig: CME 550

Project No.: 49235016

Boring Completed: 06-02-2023

Driller: MDS Midway - Casey

BORING LOG NO. B-5

Page 1 of 1

PROJECT: Trinka Davis VA - Community Living Centers

CLIENT: Guidon Design, Inc.
Indianapolis, IN

SITE: 180 Main Street
Carrollton, GA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.5901° Longitude: -85.0588°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	DEPTH					
	0.0 TOPSOIL , 1/2 Inch					
	FILL - SILTY SAND (SM) , trace mica, rock fragments and organics, red-black, loose			X	3-4-5 N=9	19.6
		5		X	2-3-5 N=8	26.0
	6.0 RESIDUUM - SANDY SILT (MH) , trace mica, red, very stiff			X	6-8-9 N=17	
	- stiff	10		X	4-6-7 N=13	
	- orange-black, medium stiff	15		X	2-2-2 N=4	
			▽			
	18.0 SILTY SAND (SM) , trace mica, fine to medium grained, white, very loose			X	2-1-2 N=3	
	- orange-black, medium dense	20				
			▽			
	25.0 Boring Terminated at 25 Feet	25		X	3-5-7 N=12	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See [Supporting Information](#) for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ 16 Feet 3 Inches While Drilling

▽ Cave In At 22 Feet 1 Inch

Terracon
2105 Newpoint Pl, Ste 600
Lawrenceville, GA

Boring Started: 06-02-2023

Drill Rig: CME 550

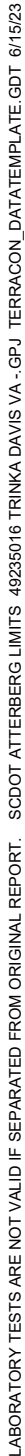
Project No.: 49235016

Boring Completed: 06-02-2023

Driller: MDS Midway - Casey

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 49235016 TRINKA DAVIS VA - GPJ TERRACON_DATATEMPLATE.GDT 6/15/23

ASTM D4318

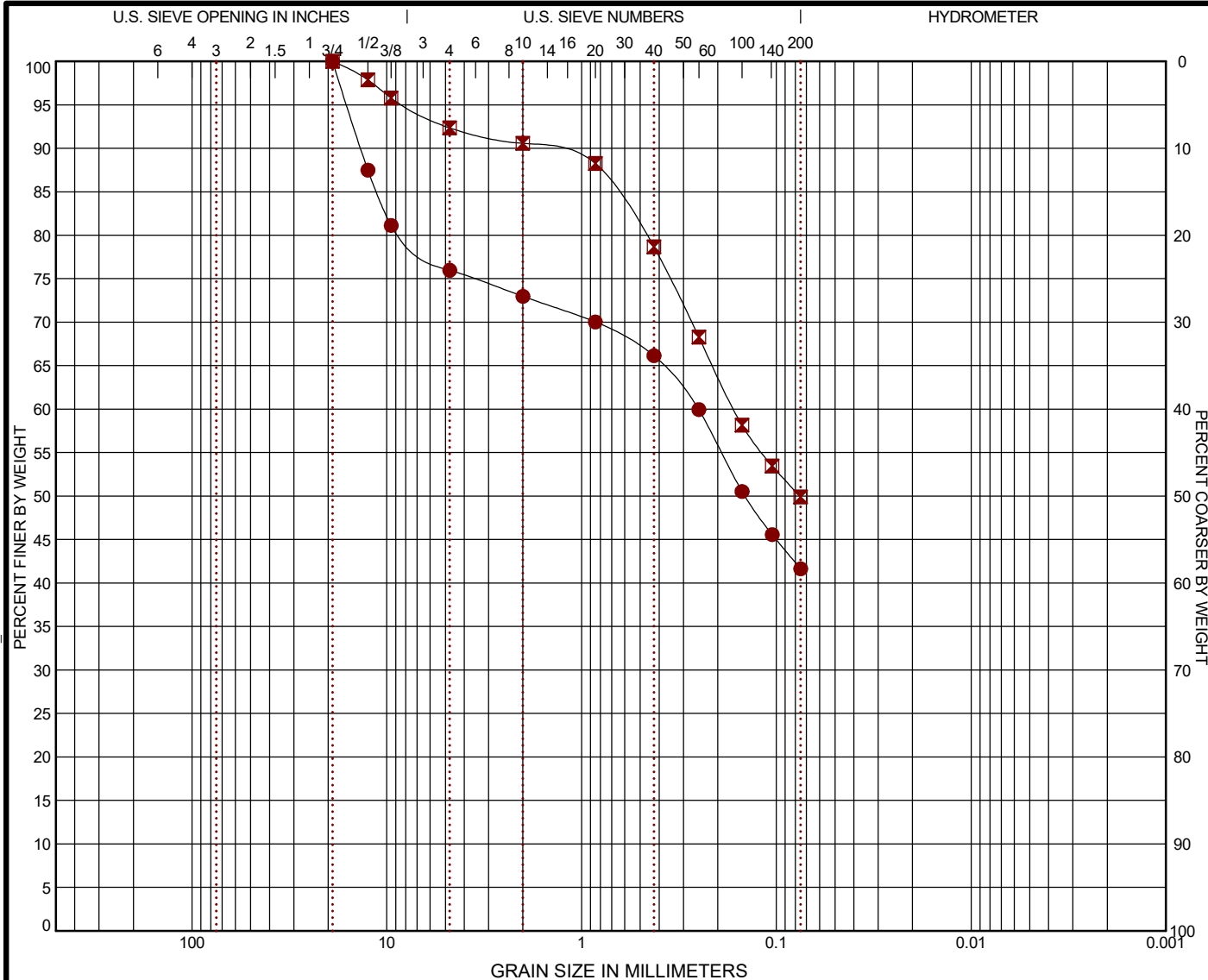


LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SCDOT ATTERBERG LIMITS 49235016 TRINKA DAVIS VA - GPJ TERRACON_DATATEMPLATE.GDT 6/15/23

CLIENT: Guidon Design, Inc.
Indianapolis, IN

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
B-1	1 - 2.5	0.0	24.0	34.3		41.6		SM
B-4	1 - 2.5	0.0	7.7	42.4		49.9		SM

GRAIN SIZE			
D ₆₀	0.251	0.165	
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/4"	100.0	3/4"	100.0		
1/2"	87.48	1/2"	97.86		
3/8"	81.12	3/8"	95.77		
#4	75.97	#4	92.34		
#10	72.96	#10	90.56		
#20	70.03	#20	88.26		
#40	66.15	#40	78.66		
#60	59.95	#60	68.3		
#100	50.53	#100	58.15		
#200	45.57	#200	53.46		
	41.64		49.89		

SOIL DESCRIPTION	
●	
×	
REMARKS	
Silt/Clay division made at .002mm in lieu of .005mm	
●	
×	

PROJECT: Trinka Davis VA - Community Living Centers

SITE: 180 Main Street
Carrollton, GA



PROJECT NUMBER: 49235016

CLIENT: Guidon Design, Inc.
Indianapolis, IN

SUPPORTING INFORMATION

Contents:

General Notes

Unified Soil Classification System

Note: All attachments are one page unless noted above.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F	
			$Cu < 4$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	GP	Poorly graded gravel ^F	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	SP	Poorly graded sand ^I	
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}	
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots on or above “A”		CL	Lean clay ^{K, L, M}
			$PI < 4$ or plots below “A” line ^J		ML	Silt ^{K, L, M}
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K, L, M, N}
			Liquid limit - not dried			Organic silt ^{K, L, M, O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line		CH	Fat clay ^{K, L, M}
			PI plots below “A” line		MH	Elastic Silt ^{K, L, M}
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K, L, M, P}
			Liquid limit - not dried			Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat	

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

