

**SECTION 27 10 00
STRUCTURED CABLING**

SPEC WRITER NOTES:

1. Use this section only for NCA projects. Delete text between // _____ // not applicable to project. Edit remaining text to suit project.
2. Contact Department of Veterans Affairs' (VA) AHJ, Spectrum Management and COMSEC Service (SMCS), Special Communications Team (SMCS 07A2), Telephone (202-461-5301/5311), for technical assistance.
3. When using this section, always include Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS in project specifications.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

SPEC WRITER NOTE: Insert cemetery name and contract identification number.

1. New state of the art fully functioning Telecommunications Infrastructure Plant (TIP) Structured Cabling System (TIP-SCS) installed in VA's National Cemetery (NCA) // _____ // to regulate communication signals to restricted buildings, // building areas, // and // fenced areas //. // Contract // Project // Number: // _____ //.
2. System includes voice, data, and signal communication signals to provide a comprehensive telecommunications and electronic safety and security communication systems.
3. See Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS for requirements governing work of this section.

1.2 RELATED REQUIREMENTS

SPEC WRITER NOTE: Update and retain references only when specified elsewhere in this section. Add new "/" replace when required.

- A. General electrical requirements common to more than one Division 27 section: Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

- B. General electrical requirements that are common to more than one Division 27: Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.
- C. Electrical Power Wiring: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- D. Electrical Power Conductors: Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- E. Electrical Power System Grounding: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- F. Electrical Power System: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS and Section 26 27 26, WIRING DEVICES.
- G. Lightning Protection: Section 26 41 00, FACILITY LIGHTNING PROTECTION.
- H. Communications System: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS, Section 27 05 33, CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS, and Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
- I. // Alarm Systems: Section 28 31 00, INTRUSION DETECTION. //
- J. // Control Systems: Section 28 10 00, ACCESS CONTROL (PACS) SYSTEM //.
- K. CFM Telecommunications and Special Telecommunications Design Manual (TDM).
- L. CFM Electrical Design Manual (EDM).

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA):
 1. 568-D-15 - Generic Telecommunications Cabling for Customer Premises.
 2. 568-D.1-15 - Commercial Building Telecommunications Infrastructure Standard.
 3. 568-D.2-15 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard.
 4. 568-D.3-15 - Optical Fiber Cabling Components Standard.
 5. 569-C-12 - Commercial Building Standard for Telecommunications Pathways and Spaces.
- C. Building Industry Consulting Service International, Inc. (BICSI™).
 1. Electronic Safety and Security Design Reference Manual.
 2. Information Technology Systems Installation Methods Manual.
 3. Outside Plant Design Reference Manual.
 4. Registered Communications Distribution Designer (RCDD) requirements.
 5. Telecommunications Distribution Methods Manual.

6. ANSI/BICSI 005 - Electronic Safety and Security (ESS) Systems Design and Implementation Best Practices (2015).
 7. NECA/BICSI 607 - Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Building (2011).
- D. Government Accountability Office (GAO):
1. 03-8-02-Security Responsibilities for Federally Owned and Leased Facilities.
- E. Institute of Electrical and Electronics Engineers (IEEE):
1. C62.41.1-2002 - IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
 2. 802.3af-08 - IEEE Standard for Information Technology.
- F. National Fire Protection Association (NFPA):
1. 70-17 - National Electrical Code (NEC).
- G. Telecommunications Industry Association(TIA):
- H. 232-F - Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data UL LLC (UL):
1. Listed - Online Certifications Directory.
- I. United States Access Board (USAB):
1. ABA - Architectural Barriers Act Accessibility Standards.
- J. United States Department of Veterans Affairs (VA):
1. VA Construction and Facilities Management (CFM):
 - a. DG OIT - Office of Information & Technology, 2011.
 - b. DM Electrical - Electrical Design Manual, 2015.
 - c. DM Telecom - Telecommunications & Special Telecommunications Systems Design Manual, 2016.
 - d. PRSDM - Physical Resilience Security Design Manual for VA Life-Safety Protected Facilities.
 2. VA Office of Security and Law Enforcement (SLA):
 - a. Directive 0730-12 - Security and Law Enforcement.
 - b. VA Office of Information and Technology (OI&T):
 - 1) Handbook 6330-93 - Directives Management Procedures.
 - 2) Handbook 6500-15 - Risk Management Framework for VA Information Systems - Tier 3: VA Information Security Program.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.5 WARRANTY

SPEC WRITER NOTE: Always retain construction warranty. FAR includes Contractor's one year labor and material warranty.

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

SPEC WRITER NOTE:

- 1. Include wiring for telephone, data, and intercom specified in Division 27 and signal and control wiring specified in Division 28 for access control, video surveillance, intrusion detection and fire detection and alarm.
- 2. Include entrance facility, backbone, and horizontal cabling. Allow for CAT5e, CAT6, fiber optic, coaxial, and twisted pair cabling with modular connectors.
- 3. Use the following diagram as a typical TIP Structured Cabling layout for minimum requirements.

- A. TIP Integration:
 - 1. Designed and date stamped by approved BICSI RCDD.
 - 2. Install and test with manufacturer guidance.
 - 3. Acceptance tested and commissioned by AHJ SMCS 07A2.
- B. TIP: Standalone, local access controls connected to remote VA Medical Center central station providing system connections and functions.

SPEC WRITER NOTE: Ensure internet connection is shown in main computer room (MCR) for system interface and control.

- 1. Protocol: Provide FTS, LEC, service providers, internet, LAN, WAN, FMS, OI&T, interconnect capability including addressable, and programmable signals.

SPEC WRITER NOTE: Confirm and specify available computer interface.

- 2. Interface: Active and passive TIP hardware via VA FTS and Telco Tie Lines // or current federal communications media //.

C. System Components Includes:

1. Interface cabinet for hard wired existing system extension.
2. Head end cabinet for standalone system.
3. Control and communications panels.

SPEC WRITER NOTE: Retain option only when
connecting access control system to
VA Medical Center central station.

4. Connect electronic security management system // fully compatible with existing Host VAMC Security Management System //.
5. Connect Card readers at restricted access entry points.
6. TIP network design Includes:
 - a. Door position indicators.
 - b. Portal control devices.
 - c. Entry control devices.
 - d. Electronic door hardware.
 - e. FMS & OI&T Power supplies.
 - f. FMS & OI&T power and control wiring, raceways, and grounding.

SPEC WRITER NOTE: Retain access control
locations and show control devices on
drawings.

D. TIP Network Design Includes Access Control Locations:

1. Administration Building:
 - a. Employee/public entrances.
 - b. Secure // designated // records storage.
 - c. Telephone, MCR, and telecom rooms.
 - d. Electrical rooms.
2. Maintenance Building:
 - a. Main building entry.
 - b. // specific interior locations. //
3. Honor Guard Building/Area:
 - a. Building entry.

SPEC WRITER NOTE: Video surveillance is
required for weapons storage. Coordinate
with Section 28 20 00, VIDEO
SURVEILLANCE.

- b. Weapons storage room.
4. Other Facilities:

a. Water storage // and water well // areas.

SPEC WRITER NOTE: List other site specific facilities requiring access control.

b. // _____. //

5. Comply with manufacturer requirements for correct system operations. Ensure system integration computers meet or exceed system software minimum system requirements.

2.2 SYSTEM PERFORMANCE

A. TIP system and system components complying with specified site // host // performance.

1. Duty Rating: Continuous service.
2. Totally functional, without degradation, to host or secondary control/management systems. If found not compliant with host facility systems, immediately contact Contracting Officer's Representative (COR) for directions.

2.3 EXISTING WIRING

A. Existing wiring is not acceptable for reuse for new installations, unless otherwise indicated by contract approved MOU cited in the system specifications and on the drawings. If indicated, only wiring that complies with specifications and applicable codes may be reused.

2.4 WIRE AND CABLES

A. Power Cables:

1. Rated for either 110 or 220 VAC, 50 or 60 Hz, and complying with Section 26 05 21, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
2. Sized according and complying with NFPA 70. High voltage power cables to be minimum three conductors, 2 sq. mm (14 AWG), stranded, and coated with non-conductive polyvinylchloride (PVC) jacket.

B. Low Voltage Power Cables:

1. Minimum 0.8 sq. mm (18 AWG), stranded with polyvinylchloride outer jacket.
2. Determine specific cable size using basic voltage over distance calculation and comply with NFPA 70 low voltage cable requirements.

2.5 CONTROL WIRING

- A. Control Wiring: 2 sq. mm (14 AWG) wire size, unless otherwise indicated.
- B. Size control wiring large enough so Voltage drop under inrush conditions does not adversely affect controls operation.

2.6 COMMUNICATION AND SIGNAL WIRING

- A. Communication and Signal Wiring: Minimum shown on drawings and as recommended by communication and signal systems manufacturer.
- B. Typical system wiring is shown on drawings and described herein. Provide wiring as required for systems being provided.
- C. Color code multi-conductor cables conductors.

2.7 UNSHIELDED TWISTED PAIR (UTP) CATEGORY 5E/6

- A. IEEE 802.3af 100BaseT UTP Level 5e/6, 0.2 sq. mm (24 AWG) plenum rated cable grade.

2.8 OPTICAL FIBER CABLE

- A. Multi-Mode Fiber:
 - 1. Core Diameter: 62.5 microns.
 - 2. Cladding Diameter: 125 microns.
 - 3. Buffer diameter: 250 microns.
 - 4. Proof Test: Minimum 50kpsi.
 - 5. Numerical Aperture: 0.275
 - 6. Attenuation: Maximum 4 dB/km at 850 nm.
 - 7. Bandwidth: Minimum 160 MHz/km at 850 nm.
 - 8. Termination: Make Multi-mode terminations with SC connectors.
- B. Single-mode Fiber:
 - 1. Core Diameter: 7 - 9 microns.
 - 2. Cladding Diameter: 125 microns.
 - 3. Buffer diameter: 250 microns.
 - 4. Proof Test: Minimum 50 kpsi.
 - 5. Numerical Aperture: 0.11.
 - 6. Attenuation: Maximum 0.5dB/Km at 1310 nm and 0.4dB/km at 1550 nm.
- C. Termination: Make Single-mode terminations with SC connectors.

2.9 TCO OUTLETS

SPEC WRITER NOTE: See TDM Section 2 for specific description.

- A. Outlets: BICSI IDC jacks meeting or exceeding Category 5e operational specification.

2.10 WIRE LUBRICATING COMPOUND

- A. Wire Lubricating Compound: Compatible with wire insulation and conduit; non-hardening non-adhering. Not acceptable for use on wire for isolated type electrical power systems.

2.11 TAPES

- A. Fireproofing Tape: Flexible, conformable fabric tape coated one side with flame-retardant elastomer.
 1. Self-extinguishing and will not support combustion, arc-proof and fireproof.
 2. Will not deteriorate when exposed to water, gases, salt water, sewage, or fungus and is resistant to sunlight and ultraviolet light.
 3. Application capable of withstanding 200-ampere arc for minimum 30 seconds.
- B. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

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 unused TIP wires and cables at COR's direction.

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 COR consideration.
- B. Conduits:
 1. Size and install conduits according to NFPA 70.
 - a. Wire Fill: Maximum 50 percent of conduit capacity, unless otherwise indicated.

2. Clearly label conduit, pull boxes, and junction boxes with colored permanent tape or paint to distinguish from other conduit and infrastructure.
3. Install non-metallic pull rope with signal and power cables to assist in future work.

C. Raceway Penetrations:

1. Enter control panels through panel bottom.
2. Seal penetrations located outdoors. Seal penetrations through building exterior enclosure.
3. Firestop penetrations through fire rated assemblies. See Section 07 84 00, FIRESTOPPING.
4. Terminate conduit riser in hot dip galvanized metal cable terminator. Fill terminator with sealant recommended by cable manufacturer.

D. Wires and Cables:

1. Install wiring in enclosed conduit system, utilizing electromagnetic tubing (EMT), equivalent in flexible metal, rigid galvanized steel (RGS), and equivalent of liquid tight, polyvinylchloride (PVC) Schedule 40 or 80.
 - a. Splice cables and wires in outlet boxes, junction boxes, or pull boxes.
 - b. Seal cable and wire entering a building from underground, between wire and conduit where cable exits conduit, with non-hardening approved compound.
2. Wire Pulling:
 - a. Prevent cutting and abrading insulation during wire installation.
 - b. Install wire using nonmetallic pull ropes.
 - c. Attach wires to pull ropes with woven basket grips or pulling eyes attached directly to conductors.
 - d. Pull multiple cables together through each conduit.
3. Terminate wires, including spare future capacity wires, at both ends with documentation, labeling and test results provided.
4. Install security system signal and power cables that traverse or originate in high security office space in either EMT or RGS conduit.
5. Install power wiring greater than 30 Volt DC and 30 Volt AC and signal cables in separate conduits.

- E. Install surge protection for cables and conductors, except fiber optic cables acting as area control, communication, and signal lines. Locate surge protection at equipment end and additional triple electrode gas surge protectors rated for application on each wire line circuit within 1 m (3 feet) of building cable entrance. Test inputs and outputs in both normal and common mode using the following wave forms:
 - 1. 10 microsecond rise time by 1000 microsecond pulse width waveform with peak voltage of 1500 volts and peak current of 60 Amperes.
 - 2. 8 microsecond rise time by 20 microsecond pulse width wave form with peak voltage of 1000 volts and peak current of 500 Amperes.
- F. Protect equipment connected to AC power from surges. Equipment protection to withstand surge test waveforms described in IEEE C62.41.1. Fuses are not acceptable to provide surge protection.

3.3 CONDUIT AND SIGNAL DUCTS

- A. Conduit:
 - 1. Minimum Conduit Size: 25 mm (1.25 inch) diameter for primary signal distribution and 25 or 19 mm (1 or 3/4 inch) for remote connections.
 - 2. Install cables in separate conduit and signal ducts. Install conduit according to Section 27 05 33, CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS.
- B. Signal Duct, Cable Duct, or Cable Tray:
 - 1. Use existing signal duct, cable duct, and cable tray only when approved by COR.
 - 2. Signal and Cable Duct: Minimum 100 mm by 100 mm (4 inch by 4 inch) inside dimensions with removable tops or sides, as required. Provide protective sleeves, guides, or barriers on sharp corners, openings, anchors, bolts, or screw ends, junction, interface and connection points.
 - 3. Cable Tray: Fully covered, mechanically and physically partitioned for multiple electronic circuit use and UL certified and labeled for telecommunication circuits and systems. Obtain technical approval in writing from Spectrum Management and Communications Security (SMCS) 0050P2H3.
 - a. Dimensions: Width and height as approved by COR.
 - 4. Do not pull wires and cables through boxes, fittings, or enclosures where change in alignment and direction occurs. Provide bend radius for each wire and cable according to manufacturer's instructions to change alignment and direction.

5. Protect wire and cable from excessive tension and damaging bending during installation by temporary guides, sheaves, rollers, and other approved means. Abrasion to wire or cable jacket is not acceptable. Replace abraded cable jackets. Discovery of abraded and damaged cables during proof of performance test will be grounds for rejecting individual telecommunication system. Completely cover edges of wire or cable pass through holes in chassis, cabinets or racks, enclosures, pull or junction boxes, and conduit with plastic or nylon grommetting.

SPEC WRITER NOTE: Verify detail drawing requirements.

6. Provide accessible cable junctions and taps. Do not install junction blocks, multi distribution connections or other distribution equipment (active or passive) items inside signal ducts. Provide minimum 150 mm by 150 mm by 100 mm (6 inch by 6 inch by 4 inch) covered junction box attached to signal duct fixed side for distribution system passive equipment installation (see detail drawing). Provide accessible equipment and connection assembly junctions.

3.4 DISTRIBUTION SYSTEM SIGNAL WIRES AND CABLES (TIP)

- A. Install and protect wires and cables to comply with NFPA 70, able to withstand any adverse environmental conditions in their respective locations without deterioration. Wires and cables to enter equipment enclosures, consoles, cabinets or racks so doors or access panels open and close without removing or disturbing cables.
- B. Routing and Interconnection:
 1. Fully capable and compliant with Facility's (local or remote) TIP and not degrade operation of local, remote, or host facility's TIP when connected.
 2. Install wires or cables between consoles, cabinets, racks, and other equipment in approved conduit, signal duct, cable duct, or cable tray secured to solid building construction.
 3. Insulate wires and cables to prevent contact with signal or current carrying conductors and shield 100 percent. Form wires or cables used in assembling consoles, panels, equipment cabinets and racks into harnesses, bundled and tied. Comb straight, form, and dress

- harnessed wires or cables in either vertical or horizontal relationship to equipment, controls, components or terminations.
4. Tie off harnesses with intertwined members termination at harness or bundle point with ample, neatly formed service loop.
 5. Group wires and cables according to service, such as AC, grounds, signal, bundle and tied off in 600 to 900 mm (24 to 36 inch) lengths. Maintain position in group throughout run. Concealed splices are not acceptable.
 6. Separate, organize, bundle, and route wires or cables to restrict channel cross-talk or feedback oscillation inside enclosures.
 - a. Looking at enclosures from rear:
 - 1) Locate AC power, DC, and speaker wires and cables on left.
 - 2) Locate coaxial, control, microphone, and line level audio and data wires and cables on right.
 - 3) Locate DC, control and signal cables may be included with any group.
 - b. Form wires and cables neatly and maintain position in group throughout conduit run.
 - c. Neatly form wires and cables in approved signal duct, conduit, cable ducts, or cable trays, with cables on right.
 - d. Install wires and cables with ties and fasteners that will not damage or distort wires or cables.
 - e. Limit spacing between tied off points to maximum 150 mm (6 inches).
 7. Install and fasten distribution cables without sharp bends or rubbing cables against sharp edges. Fasten cables with hardware which will not damage or distort them. "O" rings, "U" clamps or other types of hangers are not acceptable.
 8. Label cables with permanent markers at electronic and passive equipment terminals and at each system junction point. Cable labels to correspond to as-installed diagram lettering.
 9. Test cables after installation and replace defective cables.
 10. Provide system input and output polarity according to manufacturer's instructions. Ensure each color coded wire or cable is connected and terminated to maintain system polarity to same quality as professional audio systems. Indicate color codes, wire and cable terminations on system as-installed drawings.

3.5 OUTLET BOXES, BACK BOXES, AND FACEPLATES

- A. Outlet Boxes: Provide signal, power, interface, connection, distribution, and junction boxes as required by system design, on-site inspection, and drawings.
 - 1. See CFM's TDM for TCO outlet and cover specifics.
- B. Back Boxes: Provide back boxes according to manufacturer's instructions as required by approved system design, on-site inspection, and drawings.
- C. Face-plates (or Cover Plates): Standard type, stainless steel, anodized aluminum or UL approved cycolac plastic construction. Clearly and permanently mark connectors and jacks appearing on faceplates.

3.6 CONNECTORS

- A. Provide circuits, transmission lines and signal extensions with continuity, correct connection, and polarity. Maintain polarity between points in system:
- B. Wires:
 - 1. Neatly form wire ends and, where insulation has been cut, provide heat shrink tubing to secure insulation on each wire. No tape will be permitted.
 - 2. Install audio spade lugs on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. Provide AC barrier strips with protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal wires, but not AC wires. Wire nut and Scotchlok connectors are not acceptable for signal wire installation.
- C. Cables: Coordinate each connector with cable size and install with manufacturer's approved installation tool. Typical system cable connectors include, but are not limited to, audio spade lug, punch block, and wire-wrap.

3.7 AC POWER

SPEC WRITER NOTE: Retain first two paragraphs below if this system is to be connected to emergency circuits or standby power.

- A. Connect AC circuits which supply power to system to Facility's designated Critical Branch Emergency AC panel board and indicate on panel board directory circuits that supply power to system.
- B. Provide 120 Volt AC branch circuit, wired to separate breaker, from designated power panel to minimum quad receptacle mounted inside each equipment rack or cabinet in conduit and according to NFPA 70 for Critical Branch Emergency and Life Safety Systems.
- C. Install AC power outlet convenient to each equipment item inside equipment rack or cabinet. Extension or "pig tail" non-protected cords from system cabinet or rack to system wall outlet are not acceptable and, will be grounds to declare entire system defective.
- D. Run AC power wiring separately from signal cable.

3.8 SPLICE INSTALLATION

- A. Mechanically and electrically secure splices and terminations.
- B. Where Government determines that unsatisfactory splices or terminations have been installed, remove devices and install approved devices at no additional cost to Government.

3.9 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified, install wiring and connect to equipment and devices to perform required functions as shown on drawings and specified.
- B. Except where otherwise required, install separate power supply circuit for each system so malfunctions in any system will not impact other systems.
- C. Where separate power supply circuits are not shown on drawings, connect systems to nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install red warning indicator on branch circuit breaker handle for power supply circuit for each system to prevent accidental de-energizing of systems.

- E. System Voltages: 120 Volts or lower where shown on drawings or as required by NFPA 70.

3.10 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

- A. Install permanent wire marker on each wire at each termination.
 - 1. Markings: Permanent and legible after cleaning.
- B. Label wires with identifying numbers and letters on wire markers matching identification on wiring diagrams used for installing systems.
- C. In each handhole, install embossed brass tags to identify system served and function.

3.11 NETWORK EQUIPMENT

- A. Active network equipment shall not be part of the project, unless, requested item is approved by A/E to insure project cost accountability code is fully identified and not overspent.
- B. VA Quantico Regional Processing Center must approve installation and removal of network hardware equipment. Perform such work only with prior approval from VA Quantico Regional Processing Center.
- C. Each aforementioned suggested equipment item must be approved by the Facility OI&T Service for acceptability.

3.12 NETWORK EQUIPMENT ENVIRONMENT

- A. Locate punch down areas (location of data communication racks) where shown on drawings and where directed by A/E and VA Quantico Regional Processing Center.
- B. Provide the following:
 - 1. 100BaseT, Category 5e or Category 6 certified rack-mounted modular RJ45 punch down block/panel (24/48 ports) for jacks meeting ANSI/EIA/TIA 568-D category 5e/6 standards.
 - 2. 480 mm wide by 2100 mm high (19 inch wide by 84 inch high) steel data communication rack with three rack mounted cantilever shelves 480 mm wide by 450 mm deep (19 inches wide by 18 inches deep).
 - 3. Heavy-duty power strip (minimum 5 outlets) with surge suppression.
- C. Provide jacks on punch down block/panel corresponding to jacks at wall device faceplate.
- D. Where network equipment is located in secure room or large closet, provide dry powder extinguisher, suitable for electrical fires, within room. Provide adequate ventilation by method that does not compromise closet or room security.

3.13 NETWORK CONFIGURATION RESTRAINTS

- A. Segment comprises four pair Category 5e/6 cable.
- B. Connect pin to one wire.
- C. Maximum Link Length: 90 m (295 feet).
- D. Maximum Channel Length: 100 m (328 feet).
- E. Maximum Number of Stations Per Segment: 1.

3.14 CABLING SYSTEM INSTALLATION - GENERAL

- A. Provide cable and connecting hardware meeting or exceeding Category 5e/6 specifications, with pairs terminated according to ANSI/EIA/TIA T568-D wiring scheme.
- B. Provide complete cabling system including patch panels, horizontal cables, transition blocks, vertical cabling, modular jacks, system cables, patch cables, cable management, and comprehensive labeling system.

3.15 TCO OUTLETS

SPEC WRITER NOTE: See TDM Section 2 for detail and requirements.

- A. Minimum of 4 TCO outlets.
 - 1. Top: 2 voice outlets.
 - 2. Middle: 2 data outlets.
 - 3. Bottom: 2 blank outlet sockets with covers.
- B. Legibly label each jack at wall device faceplate corresponding to patch panel jack label.
- C. Conform to TDM and OI&T DG.
- D. Minimum number of UTP outlets to be installed in each type of workspace:
 - 1. Framed Partition Construction: Provide flush-mounted single-gang outlet boxes with two-port base plates and applicable wall device faceplates with cable installed behind gypsum board.
 - 2. // Masonry and Concrete // and // Existing // Wall Construction: Provide surface-mounted single-gang outlet boxes with two-port base plates and applicable wall device faceplates and cable installed in plastic wall mold equipped with protective insulator or sleeve.
 - 3. Modular Furniture: Locate data outlet in furniture baseboard, where networked equipment, such as computers, printers, and other devices, will be located. Provide flush-mounted single gang outlet boxes with two-port base plates and applicable wall device faceplates. If

flush-mounted single-gang outlet boxes cannot be used, provide modular surface mount boxes with two-port inserts. Install cable runs in modular furniture through furniture wire baseboard ducts/conduit.

3.16 HORIZONTAL CABLING

- A. Horizontal Wiring: Star topology connecting each network outlet jack to jack on patch panel rack in communications enclosure or room.
- B. Cable: Unshielded twisted pair.

3.17 CABLE INSTALLATION

- A. Install cable interconnecting network outlet to patch panel in one continuous length with no intermediate joins, splices or taps.
- B. Terminate cables on horizontal distribution panel or patch panel to permit additional cables to be terminated without disturbing previously installed cables.
- C. Provide two cable runs for each data outlet and device location terminating in punch down block or panel at punch down area. Maximum 24 cables may be cable tied together.
- D. Leave 2 m (6 feet) loop of cable within or on approach to each communications room and enclosure to facilitate cable future re-termination. Coil and support cable slack neatly and practically.
- E. Leave 0.5 m (20 inches) loop of cable in trunking approach to each network outlet to facilitate cable future re-termination. Terminate wire pair with maximum 13 mm (1/2 inch) untwisting at termination to connecting hardware.
- F. Install cables bends with minimum eight times cable diameter or as specified by cable manufacturer, whichever is greater. Install cable without stress caused by tension in suspended cable runs and tightly strapped bundles.
- G. Cable bundles are not acceptable to rub on, or be unduly compressed against, any building infrastructure, building equipment, cable tray, equipment racking, or other cable support.
- H. Cable bundles are not acceptable to obstruct installation and removal of equipment in equipment racks.
- I. Provide the following minimum separations where UTP cables are run parallel with electrical cables:

Circuit Rating Unshielded Power and Data		Shielded Power and Data
Less than 1 KVA	300 mm (12 inches)	25 mm (1 inch)
1 KVA to 2 KVA	450 mm (18 inches)	50 mm (2 inches)
2 KVA to 5 KVA	600 mm (24 inches)	150 mm (6 inches)
Greater than 5 KVA	1500 mm (60 inches)	300 mm (12 inches)

- J. Minimum 1 m (39 inches) separation where UTP cables are run in proximity of electrical motors or transformers.
- K. Where minimum distances specified above cannot be applied due to lack of available space, enclose data cables in rigid or flexible steel conduit. Bond conduit to ground. Provide continuity to ground at steel cabling enclosure material installations.

3.18 PATCH CABLES

- A. Copper Patch Cable: Unshielded twisted pair.
- B. Fiber Patch Cable: Same type, multi-mode or single mode, used to connect buildings.
- C. Terminate each patch lead in RJ45 connectors (male) meeting or exceeding Category 5e/6 specification.
- D. Provide one 2 m (6 feet) long copper patch cable with RJ45 connectors (male) for every cable run installed into patch panel to allow connectivity between patch panel and VA supplied switch.
- E. Provide one 7.5 m (25 feet) long copper patch cable with RJ45 connectors (male) for every cable run terminated at user and device work location to allow connectivity from networked device, such as computer, printer, and other devices, to wall jack.
- F. Provide two 7.5 m (25 feet) long fiber patch cables with SC connectors. Mode to match type connecting building. Cables allow connectivity from fiber demarcation point to switch. Ensure fiber demarcation point is within this distance to switch.

SPEC WRITER NOTE: Retain following article when Maintenance Building or other building must be connected to Administration Building.

3.19 INTER-BUILDING CABLING

A. Connecting Maintenance and Other Local Buildings With Administration Building:

1. Maximum Distance Between Cable Terminations:
 - a. Less than 100 m (328 feet): Use unshielded twisted pair.
 - b. Between 100 m (328 feet) and 2 km (1.24 miles): Use multimode 6 strand 62.5 by 125 micron fiber optic cable.
 - c. Greater than (1.24 miles): Use single-mode 6 strand 8 by 125 micron fiber optic cable.
2. Install minimum 6 strands fiber optic cable in conduit. Terminate fiber at both ends in a fiber termination box with SC connectors. Install bends with long radius conduit.
3. Fiber Optic Cable Hardware: VA Quantico Regional Processing Center will supply Cisco Catalyst Switch for installation by Contractor on an approval basis. Contact COR to arrange delivery.
 - a. Multi-mode:
 - 1) Multi-Mode ST (or OEM recommended) connector.
 - 2) MT-RJ to SC converter cable Multi-mode Fiber 62.5 by 125 microns SC connectors.
 - b. Single-mode:
 - 1) SMF uplink Single-mode Fiber 8.3 by 125 microns SC Connectors
 - c. Option: 2950G-24 with SX uplink 220m (gigabit).
4. Provide minimum 100 pair Cat 5e TWP cable, in underground conduit, between each building and terminated as described herein.
5. // Provide minimum // pairs // strands // coaxial cable // in underground conduit as described herein. //

SPEC WRITER NOTE: Radio transmission can be cost effective, but provides limited bandwidth and has special requirements.

B. Radio Frequency Transmission Bridges: Where copper or fiber transmissions are not possible due to distance or obstacles, connect multiple buildings within facility by radio frequency transmission bridges.

1. NCA utilizes Cisco Aironet Wireless Bridge and Air Fortress Security Gateway.
2. Document wireless installations for Quantico Regional Processing Center including configurations, passwords, and diagrams.

3.20 FIBER NETWORK INSTALLATION

A. Configuration Constraints:

1. Single-Mode Segment Length: Maximum 5 km (3 miles).
2. Multi-Mode Segment Length: Maximum 2 km (1 mile).

B. Installation Constraints:

1. Minimum Bend Radius During Installation: 20 times cable outside diameter.
2. Minimum Bend Radius As Installed: 10 times cable outside diameter or manufacturer's specification, whichever is greater.
3. Pulling Force During Installation: Not to exceed manufacturer's specified maximum.
4. Cable Slack:
 - a. Within pits: Minimum 2 m (6.5 feet).
 - b. At termination location: Minimum 2 m (6.5 feet).
 - c. Within termination enclosure: Minimum 0.5 m (1.5 feet).
5. Provide fiber cable terminations with SC connectors. Provide patch cord protector at wall or rack mount enclosure installations.

SPEC WRITER NOTE: A/E contact AHJ SMCS
07A2 for specific technical assistance
for TWP network installation.

3.21 TWP NETWORK INSTALLATION

3.22 FIELD QUALITY CONTROL

A. Fiber Fiber TIP Cabling System Testing:

1. Perform 100 percent Insertion Loss (light source and power meter) testing of terminated fibers in both directions at 850 nm for multimode cables and 1310 nm for single mode cables.
2. Perform OTDR tests at high wavelength, if distance is greater than 500 m (545 yards) at 1310 nm for multimode cables and greater than 1000 m (1090 yards) at 1550 nm for single mode cables.
3. Optical loss: Maximum 5 dB covering total loss between two corresponding optical ports and must include allowances for losses due to fiber, connectors, passive optical components, splices and any margin for maintenance.

4. Submit copies of test results to VA Quantico Regional Processing Center on completion of project.

B. TWP TIP Cabling System Testing:

SPEC WRITER NOTE: See TDM Section 2 for interim inspection requirement.

1. Perform testing with building electrical services operating, including lighting, power, air conditioning plant and lift services, where applicable.
2. Test wiring to verify continuity, integrity and polarity of cable according to specified pin and pair grouping assignments.
3. Submit the following cable installation documentation:
 - a. Cable type.
 - b. Route followed.
 - c. Pit locations, where applicable.
 - d. Building names.
 - e. Diagrams.
 - f. Configurations of any equipment.
 - g. Table of losses for each core.
4. Submit minimum two copies of documentation. Submit one copy to:
 - a. Director, VA National Cemetery for which work is being performed.
5. Submit installation documentation at completion of cabling system installation.
6. Certify that cabling system meets UTP cabling system requirements for Category 5e/6 performance levels.

C. Acceptance Testing:

1. Verify system components are functioning.
 - a. Perform visual check and record presence of required components and devices.
 - b. Test each item status by physically pushing and pulling; pushing in and out, and up and down.
2. Test each item for following conditions:
 - a. Properly installed.
 - b. Properly terminated.
 - c. Terminations and plugs are provided.
 - d. Cabinet Door function.
 - e. Cabinet connections provided.

- f. Cabinet mounted properly and OSHA clearances provided.
- 3. Compare TIP cabling test results and select random cables to test.
- 4. Note discrepancies on test report.
- 5. Verify As-Built System Drawings.
- 6. Verify System Manuals.

3.23 CLEANING

- A. Remove and legally dispose of debris and excess material from project site.

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