

**Department of Veterans Affairs  
Office of Information & Technology  
Enterprise Operations**

**Quantico Information Technology Center**



**Network Cabling Specifications  
National Cemetery Administration**

**February 26, 2013**

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## **1. Networks & Communication Staff Information**

Data cable specifications and installations for local area networks in VA National Cemetery administration and maintenance buildings. For technical inquiries relating to these standards, contact either the project Contracting Officer or:

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## **2. General 2.1 Codes of Practice**

Adherence to the VA/NCA Network Cable Specifications by cabling installation contractors is a condition of contract. In the event the cabling installation is sub-contracted by the prime contractor, the prime contractor will supply a copy of these specifications to the sub-contractor. This requirement shall cover all levels of sub-contracting.

Any variations to the issued job specification shall be referred for approval to the Contracting Officer Technical Representative (COTR). VA Quantico Information Technology Center (ITC) also must approve these variations.

Contractors shall install all cable and cabling products with a proven track record for data network cabling installations. Such installations shall also meet all requirements as set out in this specification.

Un-terminated "future capacity" cables are not permitted. All installed cables shall be terminated at each end and documentation, labeling and (where applicable) test results provided. This applies to all permanently installed cable types.

## **2.2 Documentation**

At least two copies of documents describing the data cable installation shall be provided. A copy to be supplied to:

1. Director, VA National Cemetery for which the work is being performed.
2. COTR for approval by VA Quantico ITC

## 2.3 Network Equipment






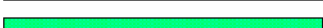


VA Quantico ITC must approve the installation or removal of network hardware equipment. Non-VA/NCA staff shall carry out such work only with prior approval from the VA Quantico ITC.

## 2.4 Network Equipment Environment

Punch down area(s) (location of the data communication rack(s)) will be determined by the building Architect/Engineer and the VA Quantico Regional Processing Center.

Contractor shall supply 100BaseT, Category 6 certified rack-mounted modular RJ45 punch down block/panel (24/48 ports) for jacks meeting the ANSI/EIA/TIA 568- B Category 6 standards.

### TIA/EIA 568B Wiring

1		White and Orange
2		Orange
3		White and Green
4		Blue
5		White and Blue
6		Green
7		White and Brown
8		Brown

Contractor will supply 1 9"W x 84"H steel data communication rack with three (3) rack mounted cantilever shelves (1 9"W x 1 8"D). or a 19" X 18"D X 25 1/4" wall mounted lockable IT cabinet with Vent fans if the IT closet does not have a lockable door.

Contractor will supply a heavy-duty power strip (minimum 5 outlets) with surge suppression.

Each jack on the punch down block/panel will correspond with the jack at the wall device faceplate.

Where network equipment is to be located in a secure room or large closet, the room or closet shall have a dry powder extinguisher, suitable for electrical fires, provided and installed within the room. Adequate through flow ventilation shall be provided in a manner that does not compromise the security of the closet

### **3. Unshielded Twisted Pair (UTP) Category 6**

IEEE 802.3 100BaseT UTP Level 6, 24 AWG plenum rated cable. Insulation - high-speed data grade. Sheath - high temperature UL data grade.

#### **3.1 Network Configuration Constraints**

Each segment comprises a four pair Category 6 cable. Pin all 8 conductors.

Maximum link length - 90 meters

Maximum channel length - 100 meters

Maximum number of stations per segment - 1.

#### **3.2 Installation Constraints 3.2.1 Installation Standards**

Cable and connecting hardware meeting or exceeding the 6 specifications shall be used throughout, with pairs terminated according to the T568B wiring scheme.

#### **3.2.2 General Requirements**

The cabling system shall include all patch panels, horizontal cables, transition blocks, vertical cabling, modular jacks, system cables, patch cables, cable management, and a comprehensive labeling system.

#### **3.2.3 Data Outlets**

The following information represents a minimum requirement for the number of UTP outlets that shall be installed in each type of workspace.

If the construction at the location of the data outlet is drywall, provide flush-mounted single-gang outlet boxes with two-port base plates and applicable wall device faceplates (cable to be installed behind drywall).

If the construction at the location of the data outlet is a solid wall, provide surface-mounted single-gang outlet boxes with two-port base plates and applicable wall device faceplates (cable to be installed in plastic wall mold equipped with protective insulator or sleeve).

Where modular furniture is used, the location of the data outlet will be in the baseboard of the furniture, where the networked equipment (computers, printers, etc) 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, then modular

Surface mount boxes will be used with two-port inserts. All cable runs in modular furniture will be through furniture wire baseboard ducts/conduit.

### **3.2.4 Horizontal Cabling**

The horizontal wiring shall be a star topology connecting each network outlet jack to a jack on a patch panel rack in a communications enclosure/room.

The cable used shall be 4-pair 100-ohm high performance, 24 AWG solid conductor, and unshielded twisted pair cable, meeting or exceeding the 6 specification.

### **3.2.5 Network Outlet and Labeling**

Each network outlet faceplate shall incorporate one or more modular, universal RJ45 IDC jack sockets meeting or exceeding the Category 6 specification. Label each jack at this wall device faceplate to correspond with the label on the patch panel jack (D1, D2, etc.). All numbering should be readily visible.

### **3.2.6 Cable Installation**

The cable interconnecting a network outlet to the patch panel shall be one continuous length with no intermediate joins, splices or taps.

Cable termination onto a horizontal distribution panel or patch panel shall be undertaken in a manner that permits additional cables to be terminated without unduly disturbing previously installed cables.

Each data outlet / device location will have two (2) cable runs that will terminate in the punch down block/panel at the punch down area.

No more than 24 cables shall be cable tied in a bunch.

A 2-meter loop of cable shall be left within or on the approach to each communications room/enclosure to facilitate re-termination of the cable in the future, should this be required. Such cable slack shall be coiled and supported in a neat and practical manner.

A 0.5-meter loop of cable shall be left in the trunking on the approach to each network outlet to facilitate re-termination of the cable in the future, should this be required.

The amount of untwisting in a pair as a result of termination to connecting hardware shall be no greater than 13mm, and less than this if possible.

Cable bend radii shall be no less than eight times the cable diameter or as specified by the cable manufacturer; whichever is the greater.

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Precautions shall be observed to eliminate cable stress caused by tension in suspended cable runs and tightly strapped bundles.

Cable bundles shall not rub on, or be unduly compressed against any building infrastructure, building equipment, cable tray, equipment racking, or other cable support.

Cable bundles shall not obstruct the installation and removal of equipment in equipment racks.

Where UTP cables are run parallel with electrical cables the following minimum separation rules shall be observed:

Circuit rating	Unshielded power/data	Shielded power/data
< 1 KVA	300mm	25mm
> 1 < 2 KVA	450mm	50mm
> 2 < 5 KVA	600mm	150mm
5 KVA	1500mm	300mm

Where UTP cables are run in the proximity of electrical motors or transformers the minimum separation shall be 1 meter.

In situations where the above minimum distances cannot be applied due to a lack of available space, data cables shall be enclosed in rigid and/or flexible steel conduit. Conduit shall be bonded to a protective ground at one point in the installation. No steel cabling enclosure medium shall be installed without having continuity to a protective ground.

### **3.2.7 Patch Cables**

The cable to be used for copper patch shall be 4 pair 100-ohm high performance, stranded conductor, unshielded twisted pair cable, meeting or exceeding the Category 6 specifications.

The cable to be used for fiber patch shall be of the same type (multi-mode or single mode – see specifications in section 4 below) of what is used to connect the buildings.

Each patch lead shall be terminated in RJ45 connectors (male) meeting or exceeding the Category 6 specification.



Contractor will supply one (1) 4' category 6 patch cable with RJ45 connectors (male) for every cable run installed into the patch panel. This will allow connectivity between the patch panel and VA supplied switch.

Contractor will supply one (1) 25' category 6 patch cable with RJ45 connectors (male) for every cable run terminated at the user/device work location. This will allow connectivity from the networked device (computer, printer, etc) to the wall jack.

The Quantico ITC will supply the multi-mode or single-mode fiber patch cables with SC or ST connectors. This will allow connectivity from the demarcation point of the fiber to the switch. Ensure the demarcation point of the fiber is within 10' from the patch panel.

### **3.3 Inter-Building Cabling**

#### **Wiring Maintenance or other local buildings:**

If local network connectivity for Maintenance or other local buildings is required, follow all specifications as stated in this document.

#### **Connecting Maintenance or other local buildings with the Administration Building:**

If the distance between the punch down area in the Administration Building to the punch down area in the Maintenance Building does not exceed 100m or 328' (maximum length of the cable run), then 100BaseT UTP Level 6 24AWG plenum 4 pair cable may be used. Two cables will be required and must be installed in conduit that will connect the two buildings.

If the distance to the punch down area in the Maintenance Building exceeds 100m / 328' but is no more than 2km / 1.24 miles (maximum length of the cable run), then use a multimode fiber 6 strand 62.5x125 microns cable. Cable should be routed as shown on the contract drawing.

If the distance to the maintenance building exceeds 2km / 1.24 miles but is no more than 5km / 3.10 miles, then single-mode fiber 6 strand 8x125 microns is recommended.

If fiber is used to connect multiple buildings, a minimum of 6 strands will be required and must be installed in conduit. All fiber will be terminated within a fiber termination box (at both ends) with SC or ST connectors. All bends will be made with long radius conduit.

Below is a list of hardware that is required if fiber is installed. VA Quantico ITC will supply the Cisco Catalyst Switch for installation by the contractor on an approval basis. Contact the COTR to arrange delivery.

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Multi-mode  
Cisco Catalyst 2960-8/24/48  
Cisco GLC-FE-100FX  
LC to SC/ST patch cable  
Multi-mode Fiber 62.5x125 microns  
SC/ST connectors

Single-mode  
Cisco Catalyst 2960-8/24/48  
Cisco GLC-FE-100LX  
LC to SC/ST patch cable  
Single-mode Fiber 8.3x125 microns  
SC/ST connectors

## **Radio Frequency Transmission Bridges**

Where copper or fiber transmissions are not possible due to distance, obstacles or funding, another option to connect multiple buildings within a facility includes radio frequency transmission bridges. This solution can be cost effective, however, provides limited bandwidth and has special requirements. Several cemeteries are utilizing this RF solution with remote bridges. NCA utilizes the Cisco Aironet encrypted wireless bridge for this transmission design. All wireless installations will be documented and supplied to the Quantico ITC; this includes but is not limited to configurations, passwords, and diagrams.

## **3.4 Testing**

Testing shall be carried out with building electrical services operating (lighting, power, air conditioning plant and lift services where applicable).

Wiring shall be tested to verify the continuity, integrity and polarity of the cable according to the specified pin and pair grouping assignments.

## **3.5 Documentation**

The contractor shall provide installation documentation at the completion of the cabling system installation.

The contractor shall certify that the cabling system meets the UTP cabling system requirements for Category 6 performance levels.

## **4. Optical Fiber Cable (Ethernet)**

Multi-mode Fiber:

- Core diameter 62.5 microns
- Cladding diameter 125 microns
- Prim. Acryl. Buffer diameter 250 microns

Proof test not less than 50kpsi.  
Numerical aperture 0.275  
Attenuation not greater than 4dB/km @ 850nm.  
Bandwidth not less than 160MHz/km @ 850nm.  
Termination: All Multi-mode terminations shall be made with SC or ST connectors

#### Single-mode Fiber

Core Diameter 7 - 9 microns  
Cladding diameter 125 microns  
Prim. Acryl. Buffer diameter 250 microns  
Proof test not less than 50kpsi.  
Numerical aperture 0.11  
Attenuation not greater than 0.5dB/Km @ 1310nm. not greater than 0.4dB/Km @ 1550nm.

Termination: All Single-mode terminations shall be made with SC or ST connectors

### **4.1 Fiber Network Configuration Constraints**

Maximum Single-mode segment length – 5 km  
Maximum Multi-mode segment length - 2 km

### **4.2 Installation Constraints**

Minimum bend radius (during installation) - not less than 20 X outside diameter of cable.

Minimum bend radius (as installed) - not less than 10 X outside diameter of cable or the manufacturer's specification, whichever is the greater.

During installation the pulling force shall not exceed the manufacturer's specified maximum.

Cable slack shall be provided as follows:

Within pits - 2 meters minimum.  
At a termination location - 2 meters minimum.  
Within a termination enclosure - 0.5 meter minimum.

All fiber cable terminations are to be SC or ST connectors. When using a wall or rack mount enclosure, a patch cord protector shall be included in the installation.

### **4.3 Testing**

100% Insertion Loss (light source and power meter) testing of all terminated fibers shall be performed in both directions at 850nm for multimode cables and 1310nm for single mode cables.

OTDR tests shall be performed at high wavelength, if the distance is greater than 500m at 1310nm for multimode cables and greater than 1000m at 1550nm for single mode cables.

Optical loss covers the 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. This loss shall not exceed 5db.

Copies of all test results are to be provided to the VA Quantico ITC on completion of the project.

### **4.4 Documentation**

Documentation of a cable installation shall comprise the following with copies provided to the cemetery director and the Quantico ITC Network Section (See Contact information at beginning of document):

- Cable type
- Route followed
- Pit locations (where applicable)
- Building names
- Building Cable Diagrams (internal/external) showing locations of each drop or termination point
- Configurations of equipment.
- Table of losses for each core