

**SECTION 28 20 00  
VIDEO SURVEILLANCE**

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:
1. Closed circuit television system.
- B. 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.

- A. For firestopping application and use, Section 07 84 00, FIRESTOPPING.
- B. For labeling and signs, Section 10 14 00, SIGNAGE.
- C. Section 26 05 11For power cables, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- D. Section 26 05 26Section 26 05 33For alarm systems, Section 28 16 11, INTRUSION DETECTION SYSTEM (IDS).
- E. For General Requirements, Section 01 00 01, GENERAL REQUIREMENTS.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
  1. 330-09 - Electrical Performance Standards for CCTV Cameras.
- C. Institute of Electrical and Electronics Engineers (IEEE):

1. C62.41-02 - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
2. 802.3af-08 - Power over Ethernet Standard.
- D. National Electrical Contractors Association (NECA):
  1. 303-2005 - Installing Closed Circuit Television (CCTV) Systems.
- E. National Electrical Manufacturers Association (NEMA):
  1. 250-14 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. National Fire Protection Association (NFPA):
  1. 70-17 - National Electrical Code (NEC).
- G. Federal Information Processing Standard (FIPS):
  1. 140-2-02 - Security Requirements for Cryptographic Modules.
- H. UL LLC (UL):
  1. 983-06 - Standard for Surveillance Camera Units.
  2. 2044-08 - Standard for Surveillance Closed Circuit Television Equipment.
- I. United States Department of Veterans Affairs (VA):
  1. VA Construction and Facilities Management (CFM):
    - a. DM Electrical - Electrical Design Manual, 2015.

#### 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 REQUIREMENTS

- A. CCTV system to comply with UL 2044 and operate on // 120 // 240 // Volt AC; // 50 // 60 // Hz power system, with backup power system that will provide minimum 96 hours run time in the event of power failure.
- B. Design, engineer, install, and test CCTV System to ensure components are fully compatible as a system and can be integrated with associated security subsystems, whether system is stand-alone or complete network.

- C. Integrate CCTV System where appropriate with security subsystems:
1. PACS:
    - a. Provide 24 hour coverage of all entry points to perimeter and agency buildings and all emergency exits utilizing fixed color camera.
    - b. Record cameras on 24 hour basis.
    - c. Programmed go into alarm state when an emergency exit is opened, and notify Access Control System and Database Management of an alarm event.
  2. IDS:
    - a. Provide recorded alarm event via color camera connected to IDS system by direct hardware or security system computer network.
    - b. Record cameras on 24 hours basis.
    - c. Be programmed to go into alarm state when an IDS device is put into an alarm state, and notify Police and Engineering.
    - d. For additional CCTV System requirements as they relate to the IDS, refer to Section 28 31 00, INTRUSION DETECTION.
  3. Security Access Detection:
    - a. Provide full coverage of vehicle and lobby entrance screening areas utilizing fixed color camera.
    - b. Record cameras on 24 hours basis.
    - c. Provide CCTV System with facial recognition software to assist in identifying individuals for current and future purposes.
  4. EPPS:
    - a. Provide recorded alarm event via color camera connected to EPPS system by direct hardware or security system computer network.
    - b. Record cameras on 24 hours basis.
    - c. Be programmed to go into alarm state when emergency call box or duress alarm/panic device is activated, and notify Access Control System and Database Management of an alarm event.
- D. Integration with these security subsystems to be achieved by computer programming or direct hardwiring of systems.
- E. For programming purposes refer to manufacturer's instructions for correct system operations. Ensure computers being utilized for system integration meet or exceed minimum system requirements outlined on system's software packages.
- F. Complete CCTV System to 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.
- G. Visit site and verify that site conditions are in agreement and compliance with design package. Submit report of all changes to site or conditions that will affect system performance to Contracting Officer's Representative (COR). Do not take any corrective action without written permission received from COR.
- H. Existing Equipment:
1. Connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in design package. Video equipment and signal lines that are usable in their original configuration without modification may be reused with COR approval.
  2. Perform field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into CCTV System, and provide report to COR as part of site survey report. For those items considered nonfunctioning, provide (with report) specification sheets, or written functional requirements to support findings and estimated cost to correct deficiency. As part of report, include schedule for connection to all existing equipment.
  3. Make written requests and obtain approval before disconnecting any signal lines and equipment, and creating equipment downtime. Proceed with such work only after receiving COR approval of requests. If any device fails after work has commenced on that device, signal or control line, diagnose failure and perform necessary equipment corrections.
  4. Contractor will be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.
  5. Provide COR with full list of all equipment to be removed or replaced, including description and serial/manufacturer numbers, where possible. Dispose of all equipment that has been removed or

replaced based upon COR approval after reviewing equipment removal list. In all areas where equipment is removed or replaced, repair those areas to match current existing conditions.

- I. Enclosure Penetrations: All enclosure penetrations will be from bottom of enclosure unless system design requires penetrations from other directions. For penetrations of interior enclosures involving transitions of conduit from interior to exterior, seal penetrations on exterior enclosures with rubber silicone sealant to preclude water infiltration and comply with Section 07 84 00, FIRESTOPPING. Terminate conduit riser in hot-dipped galvanized metal cable terminator. Fill terminator with approved sealant as recommended by cable manufacturer without damaging cable.
- J. Cold Galvanizing: Coat field welds and brazing on factory galvanized boxes, enclosures, and conduits with cold galvanized paint containing at least 95 percent zinc by weight.
- K. Interconnection of Console Video Equipment: Connect signal paths between video equipment as specified by OEM.
- L. Provide cables of sufficient lengths for rack mounted equipment on slide mounts to allow full extension of slide rails from rack.

## 2.2 EQUIPMENT

- A. See Section 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.

### SPEC WRITER NOTE:

1. A/E to develop site specific CCC installation specification with facility's using service and AHJ SMCS 07A2.
2. A/E to develop CCC construction specifications to comply with TDM requirements, when no CFM specification is available.

- B. Custom Control Console (CCC) and cabinets:
  1. Meets system's specific requirements in PCR, ECR, and EMCR.
- C. Provide CCTV system meeting following requirements:
  1. Cameras: UL 983 compliant.
  2. Charge coupled device (CCD) cameras conforming to National Television System Committee (NTSC) formatting.
  3. Fixed color cameras and primary choice for monitoring following activities described below. Pan/Tilt/Zoom (P/T/Z) cameras to be color and utilized to compliment fixed cameras.

4. System powered by 12 Volts direct current (VDC) or 24 VAC. Power supplies, to be Class 2 and UL compliant and have back-up power source to ensure cameras are still operational in event of loss of primary power to CCTV System.
5. Rated for continuous operation under the following environmental conditions:
  - a. Ambient temperatures of minus 10 degrees C (14 degrees F) to 55 degrees C (131 degrees F) utilizing equipment that will provide automatic heating and cooling.
  - b. Humidity, wind gusts, ice loading, and seismic conditions specified or encountered for locations where CCTV cameras will be utilized.
6. Home run to monitoring and recording device via controlling device such as matrix switcher or network server and monitored on 24 hour basis at designated Access Control System and Database Management location.
7. Each function and activity to be addressed within system by unique twenty (20) character user defined name. Use of codes or mnemonics identifying CCTV action is not acceptable.
8. Furnished with built-in video motion detection that automatically monitors and processes information from each camera. Camera motion detection will detect motion within camera's field of view and provide automatic visual, remote alarms, and motion-artifacts as result of detected motion as follows:
  - a. Motion-detection settings to include adjustable object size and velocity, as well as selectable detection area of 132 zones in twelve (12) by eleven (11) grid.
  - b. Sensors to accept video signals from CCTV cameras and, when synchronizing is required, be in composite synchronization.
  - c. Sensor processors that detect motion by digitizing multiple pixels within each video scene and by comparing pixel gray scale to previously stored reference. Number of pixels digitized depends on application. System designer should consider cost effectiveness since digitizing large number of pixels could increase cost dramatically with little additional actual detection capability for specific application.
  - d. Alarm will be initiated when comparison varies by six (6) percent or more.

9. Design, provide, and post appropriate signage to notify people that an area is under camera surveillance.
10. Dummy or fake cameras will not be utilized.
11. Programmed to digitally flip from color to black and white at dusk and vise-versa at dawn.
12. Fitted with auto-iris lenses to ensure image is maintained in low light.
13. Lightning protection to be IEEE C62.41 compliant and provided for all cameras. Surge protectors or lightning grid may be utilized. Ensure lightning protection equipment is compliant with NFPA 70 (Article 780). Use of fuses and circuit breakers as lightning protection is not acceptable.
14. For camera as part of CCTV network, provide video encoder to convert National Television Systems Committee (NTSC) signal to Moving Picture Experts Group (MPEG) format.
15. Utilize P/T/Z cameras to complement fixed cameras, not as primary means of monitoring activity.
16. Fixed Color Cameras Technical Characteristics:

Imaging Device	1/3 inch interline transfer CCD
Picture Elements	NTSC 510 (H) x 492 (V)
Scanning System	NTSC 525 lines, 21 interlace
Synchronization System	AC line lock/internal
Horizontal Resolution	330 TV lines
Iris Control	Selectable on/off
Electronic Shutter Range	NTSC 1/60-1/100,000 second
Auto Iris Lens Type	DC/video drive (auto sensing)
Minimum Illumination	0.6 lux
Signal to Noise Ratio	Greater than 50 dB
Automatic Gain Control	On/off switchable
Backlight Compensation	On/off switchable
Auto White Balance	On/off switchable
Video Output	1 Vp-p, 75 ohms
Power Consumption	Less than 5 watts
Video Connector	BNC
Lens Mount	C/CS mount (adjustable)

17. P/T/Z Cameras Technical Characteristics:

Effective Pixels	768 (H) x 494 (V)
Scanning Area	1/4-type CCD
Synchronization	Internal/Line-lock/Multiplexed Vertical Drive (VD2)
Video Output	1.0 v[p-p] NTSC composite/75 ohm
H. Resolution	570-line at B/W, or 480-line at color imaging
Signal-to-noise Ratio	50dB (AGC off, weight on)
Super Dynamic II	64 times (36dB) (selectable on/off)
Minimum Illumination	0.06 lx (0.006 fc) at B/W, 1 lx(0.1 fc)
Zoom Speed	Approx. 2.1s (TELE/WIDE) in sequence mode
Focus Speed	Approx. 2s (FAR/NEAR) in sequence mode
Iris	Automatic (Open/Close is possible)/manual
Maximum Aperture Ratio	1: 1.6 (Wide) ~ 3.0 (Tele)
Focal Length	3.79 ~ 83.4 mm (0.15 ~ 3.3 inch)
Angular Field of View	H 2.6° ~ 51.7° V 2.0° ~ 39.9°
Electronic Shutter	1/60 (off), 1/100, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/10,000 s
Zoom Ratio	Optical 22x w/10x electronic zoom
Iris Range	F1.6 ~ 64, Close
Panning Range	360° endless
Panning Speed	Manual: Approx. 0.1°/s ~ 120°/s 16 steps
Tilting Range	0 ~ 90° (Digital Flip off), 0 ~180° (Digital Flip on)
Tilting Speed	Manual: Approx. 0.1°/s ~ 120°/s. 16 steps
Pan/Tilt	Manual/Sequential position/Auto Pan
Controls	Pan/Tilt, Lens, 64 Preset Positions, Home Position
Video Connector	BNC
Controller I/F	Multiplex-coaxial



## 2.3 CAMERAS

### A. General Requirements:

1. UL 983 compliant.
2. Conform to National Television System Committee (NTSC) format.

### B. Fixed Cameras:

1. Pan/Tilt/Zoom capability.
2. Powered by // 12 // 24 // Volt AC, with Class 2, UL compliant power supply.
3. Rated for continuous operation under the following environmental conditions:
  - a. Ambient temperatures of minus 10 degrees C (14 degrees F) to 55 degrees C (131 degrees F). Provide automatic heating and cooling.
  - b. Humidity, wind gusts, ice loading, and seismic conditions specified or encountered for locations where CCTV cameras will be utilized.

### C. Power over Ethernet (PoE) Cameras:

#### 1. General Requirements:

- a. IEEE 802.3af compliant.
- b. Utilized only as part of CCTV Network and not integrated with standard analog or digital CCTV System equipment.
- c. Utilized for interior and exterior purposes.
- d. Routed to controlling device via network switcher or direct connection to network server.
- e. Hybrid design with both Internet Protocol (IP) output and monitor video output which produces picture equivalent to analog camera, and allows simultaneous output of both.
- f. Provide minimum 200,000 effective pixels with built-in complementary color filter for accurate color with no image lag or distortion.
- g. Programmable IP address that allows installation of multiple units in same Local Area Network (LAN) environment.
- h. Incorporate minimum of Transmission Control Protocol (TCP)/IP, User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Internet Control Message Protocol (ICMP0), Address Resolution Protocol (ARP), Real-Time Transport Protocol (RTP), Dynamic Host Configuration Protocol (DHCP), Network Time Protocol (NTP), Simple Mail Transfer

Protocol (SMTP), Internet Group Management Protocol (IGMP), and Differentiated Service Code Point (DSCP) protocols for various network applications.

2. Provide Category (CAT)-V cable as primary source for carrying signals maximum 100 m (300 ft.) from switch hub or network server. If any camera is installed over 100 m (300 ft.) from controlling device then the following will be required:
  - a. Local or remote 12 Volt DC or 24 Volt AC power source from Class 2, UL compliant power supply.
  - b. Signal converter to convert from CAT-V cable over to fiber optic or standard signal cable. Signal will be required to convert back to CAT-V cable at controlling device using signal converter card.
3. Technical Characteristics:

Video Standards	MPEG-4; M-JPEG
Video Data Rate	9.6 Kbps - 6 Mbps Constant & variable
Image Resolution	768x494 (NTSC)
Video Resolution	704 x 576/480 (4CIF: 25/30 IPS) 704 x 288/240 (2CIF: 25/30 IPS) 352 x 288/240 (CIF: 25/30 IPS) 176 x 144/120 (QCIF: 25/30 IPS)
Select Frame Rate	1-25/30 IPS (PAL/NTSC); Field/frame based coding
Network Protocols	RTP, Telnet, UDP, TCP, IP, HTTP, IGMP, ICMP
Software Update	Flash ROM, remote programmable
Configuration	Via web browser, built-in web server interfaces
Video Out	1x Analog composite: NTSC or PAL; BNC connector 75 Ohm
Sensitivity	1 0.65 lux (color) 0.26 lux (NightSense)
Minimum Illumination	0.30 lux (color)0.12 lux(NightSense)
Video Signal-to-Noise Ratio	50 dB

Video Standards	MPEG-4; M-JPEG
Video Signal Gain	21 dB, (max) Electronic Shutter Automatic, up to 1/150000 sec. (NTSC)
Alarm In	Automatic sensing (2500 - 9000 K)
Input Voltage	+5 V nominal, +40 Volt DC max VDC: 11-36 V (700 mA) VAC: 12-28 V (700 mA) PoE: IEEE 802.3af compliant

D. Wireless Cameras:

1. General Requirements:
  - a. Ensure operating frequency is given full approval by VA controlling authority before installation of any wireless camera.
  - b. Utilize wireless cameras as part of CCTV network or standard analog system.
  - c. Meets Federal Communication Commission (FCC) approval and compliancy.
2. Power: 110 Volt AC tied into dedicated circuit breaker on dedicated power panel to security system and fed from power source with back-up in the event primary power to CCTV System is lost.
  - a. Run power to camera and connect at both ends according to Division 26 Sections and DM Electrical.
3. Locate wireless cameras within minimum one quarter mile of receiving unit. Provide repeaters as required to ensure strongest possible signal between transmitters and receivers.
  - a. Utilize the following equipment to ensure system operation:
    - 1) Receiver.
    - 2) Receiver antenna, as required.
    - 3) Repeater, as required.
    - 4) Mounting hardware.
4. Receivers: Provide maximum four (4) cameras per unit.
5. Technical Characteristics:
  - a. Wireless Cameras:

Imaging Device	1/3 inch interline transfer CCD
Picture Elements	NTSC 510 (H) x 492 (V)
Sensing Area	6 mm diagonal
Scanning System	NTSC 525 lines, 21 interlace
Synchronization System	AC line lock/internal
Horizontal Resolution	330 TV lines
Iris Control	Selectable on/off
Electronic Shutter Range NTSC	1/60-1/100,000 second
Frequency range	2.41-2.47GHz
Modulation	FM
Video signal/noise ratio	48dB
Audio signal/noise ratio	45db
Minimum Illumination	0.6 lux
Signal to Noise Ratio	Greater than 50 dB
Automatic Gain Control	On/off switchable
Backlight Compensation	On/off switchable
Auto White Balance	On/off switchable
Video Output	1 Vp-p, 75 ohms
Lens Mount	C/CS mount (adjustable)

## 1) Receivers:

Frequency range	2.4-2.49GHz
Video output	1V P/P
Signal/noise ratio	38dB

**2.4 LENSES**

## A. General Requirements:

1. Provides maximum coverage of area being monitored by camera.
2. Provide lenses 8.5 mm (0.33 inches) to fit CCD fixed camera.
3. Glass with coated optics.
4. Mounts compatible with camera selected.
5. Packaged and furnished with camera.
6. Maximum f-stop of f/1.3 for fixed lenses, and maximum f-stop of f/1.6 for variable focus lenses.
7. Equipped with auto-iris mechanism.
8. Sufficient circle of illumination to cover image sensor evenly.

9. Not to be used on camera with image format larger than lens is designed to cover.

10. Pre-set capability.

B. Manual Variable Focus:

1. Provide manual variable focus lenses in large areas being monitored such as perimeter fence lines, vehicle entry points, parking areas, and areas indicated on Drawings.

2. Manual variable focus lenses to allow for setting virtually any angle of field, which maximizes surveillance effects.

3. Technical Characteristics:

Image format	1/3 inch
Focal length	5-50mm
Iris range	F1.4 to close
Focus range	1m (3.3 ft.)
Back focus distance	10.05 mm (0.4 inches)
Angle view Wide (1/3 inches)	53.4 x 40.1
Angle view Tele (1/3 inches)	5.3 x 4.1
Iris control	manual
Focus ctrl	manual
Zoom ctrl	manual

C. Auto Iris Fixed:

1. Provide auto iris fixed lenses in areas where small specific point of reference is monitored such as doorways, elevators, and locations indicated on Drawings.

2. Provide focal length calculation using focal length calculator or focal length chart provided by lens manufacturer.

3. Technical Characteristics:

Image format	1/3 inch	1/3 inch	1/3 inch
Focal length	2.8 mm	4 mm	8 mm
Iris range	F1.2 - 200	F1.2 - 200	F1.2 - 200
Min. Object	0.3 m (1 ft)	0.3 m (1 ft)	0.3 m (1 ft)
Lens mount	CS-mount	CS-mount	CS-mount
Angle of view	94 X 72	64 X 49	33 x 25
Focus control	Manual	Manual	manual

## 2.5 VIDEO DISPLAY EQUIPMENT

1. Video display equipment to consist of color monitors and be able to display analog, digital, and other images in NTSC or MPEG format associated with operation of Security Management System (SMS). Other requirements include the following:
  - a. Front panel controls for power on/off, horizontal and vertical hold, brightness, and contrast.
  - b. Accept multiple inputs, directly or indirectly.
  - c. Capable of observing and programming CCTV System.
  - d. Installation cannot be witnessed by general public.
2. Color Video Monitors Technical Characteristics:

Sync Format	PAL/NTSC
Display Tube	90 degree deflection angle
Horizontal Resolution	250 TVL minimum, 300 TVL typical
Video Input	1.0 Vp-p, 75 Ohm
Front Panel Controls	Volume, Contrast, Brightness, Color
Connectors	BNC

3. Liquid Crystal Display (LCD) Flat Panel Display Monitor:
  - a. Technical Characteristics:

Sync Format	PAL/NTSC
LCD Panel	TFT LCD
Resolution	1280 x 1024 pixels; 500 TV
Contrast Ratio (CR)	500: 1
Viewing Angle	140 degree horizontal, 130 degree vertical
Video Input	(CVBS) 1.0 Vp-p (0.5-1.5 Vp-p), 75 Ohm Y/C (S-video) 0.7 Vp-p, 0.3 Vp-p, 75 Ohm
Video 1	Composite video two (2) BNC (1 in, 1 out)
Video 2	Composite video two (2) BNC (1 in, 1 out)

Sync Format	PAL/NTSC
Y/C (S-video)	two (2) mini-dins, 4-pin (1 in, 1 out)

## 2.6 CAMERA HOUSINGS AND MOUNTS

### A. Environmentally Sealed:

#### 1. General Requirements:

- a. Provides condensation free environment for correct camera operation.
- b. Operate in 100 percent condensing humidity atmosphere.
- c. Equipped with fill valve for introduction of nitrogen into housing to eliminate existing atmospheric air and pressurize housing to create moisture free conditions.
- d. Equipped with overpressure valve to prevent damage to housing by over pressurization.
- e. Equipped with humidity indicator, visible at all times, to ensure correct atmospheric conditions.
- f. Maximum housing leak rate of 13.8kPa (2 lbs./sq.in.) at sea level in 90 day period.
- g. Camera mounts or supports as required for correct positioning of camera and lens.
- h. White housing and sunshield.

2. Provide all electrical and signal cables required for correct operations in hardened carrier system from controller to camera.
3. Provide adjustable mounting brackets for housing weight of camera and housing unit.
4. Camera and mount accessibility required for maintenance and service purposes.

### B. Indoor Mounts:

#### 1. Ceiling Mounts:

- a. Fasten enclosure and mount to finished or suspended ceiling.
- b. Do not support enclosure mount from ceiling metal suspension system. Provide support according to mount manufacturer's instructions.
- c. Suspended ceiling mounts to be low profile and suitable for replacement of 610 mm by 610 mm (2 foot by 2 foot) ceiling panels.

#### 2. Wall Mounts:

- a. Enclosure installation to match existing décor, placed at unobtrusive height, unable to cause personal harm, and prevent tampering and vandalism.
  - b. Provide mounts with manual pan/tilt head for 360 degree horizontal and vertical positioning from horizontal position and locking bar or screw to maintain its fixed position once adjusted.
- C. Domes:
- 1. Domes to be pendant mount, pole mount, ceiling mount, surface mount, or corner mounted equipment.
    - a. Interior Dome Construction:
      - 1) Lower portion that provides camera viewing to be black opaque acrylic and have light attenuation factor of maximum 1 f-stop.
      - 2) Housing to be equipped with integral pan/tilt capabilities complete with wiring, wiring harness, connectors, receiver/driver, pan/tilt control system, pre-position cards, or other hardware and equipment as required for fully functional pan/tilt dome.
    - b. Exterior Domes Construction:
      - 1) Lower portion that provides camera viewing to be black opaque acrylic and have light attenuation factor of maximum 1 f-stop.
      - 2) Housing to be dust and water tight, and fully operational in 100 percent condensing humidity.
  - 2. Pan/Tilt Mechanism:
    - a. Constructed of heavy duty bearings and hardened steel gears.
    - b. Permanently lubricated to ensure smooth and consistent movement of all parts for life of product.
    - c. Equipped with motors thermally or impedance protected against overload damage.
    - d. Pan Movements: 360 degrees and tilt movement minimum +/- 90 degrees.
    - e. Pan Speed: Minimum 10 degrees per second.
- D. Exterior Wall Mounts:
- 1. Provide mounts with adjustable head for camera mounting.
    - a. Head adjustable for minimum plus and minus 90 degrees of pan, and minimum plus and minus 45 degrees of tilt.



2. Constructed of aluminum, stainless steel, or steel with corrosion-resistant finish.
  - a. Install mounts at height that allows for maximum coverage of area being monitored.

E. Explosion Proof Housing:

1. Housing to meet or exceed all requirements of NEMA 250 for Type 4 enclosures for hazardous locations.
2. Provide mounting brackets as specified for camera and lens.

## 2.7 CONTROLLING EQUIPMENT

A. Controlling equipment to be utilized to call up, operate, and program cameras associated CCTV System components:

1. Operates cameras locally and remotely. Utilize matrix switcher or network server as CCTV System controller.
2. Fit controller into standard 47.5 cm (19 inch) equipment rack.
3. Provide control and programming keyboards with its own type of switcher. Keyboards to meet the following:
  - a. Located at each monitoring station.
  - b. Addressable for programming purposes.
  - c. Provide interface between operator and CCTV System.
  - d. Provide full control and programming of switcher.
  - e. Minimum controls:
    - 1) Programming.
    - 2) Switching.
    - 3) Lens function.
    - 4) Pan/Tilt/Zoom.
    - 5) Environmental housing.
    - 6) Annotation.
4. Matrix Switcher: Meet the following minimum requirements:
  - a. Take multiple camera inputs and route them to multiple monitoring stations.
  - b. Allow for centralized user management controlling configurations.
  - c. Provide live viewing of cameras.
  - d. Provide P/T/Z, focus, and iris control of unitized cameras.
  - e. Be expandable to allow for addition of multiple cameras and monitoring stations over life of system visual identification system by utilizing input and output video and controller cards.

- f. Input cards to allow for addition of minimum four (4) camera inputs per card.
- g. Output cards to allow for addition of minimum eight (8) outputs per card.
- h. Have ability to be programmed locally or remotely.
- i. Remotely operate multiple cameras from multiple stations.
- j. Fully interface with digital video recorder (DVR) for recording of all events.
- k. Utilize RS-232 or fiber optic connections for integration with SMS computer station via remote port on network hub.
- l. Alarm interface compatible with all associated security subsystems. Alarm inputs to be via relay or EIA ANSI/EIA/TIA-232-F interface. Interface allowing for minimum 24 alarm inputs and 12 alarm outputs.
- m. Switcher response time to alarm input to be minimum 200 milliseconds from time an alarm is sensed until picture is displayed on monitor.
- n. Switcher with built in buffer to allow back-log of alarms. Viewable alarms by operator.
- o. Addressable if multiple matrix switchers are connected to SMS.
- p. Configured, i.e. camera names, monitor names, sequences, alarms and alarm actions, etc. utilizing configuration program and tools provided by matrix manufacturer.
- q. Matrix switcher meeting the following minimum input/output requirements:

Camera inputs	16
Video outputs	4
Keyboard/Controller Outputs	4
Alarm inputs	323

- 5. Matrix switcher having the following components and technical characteristics:
  - a. Main Unit:

Functions	Monitor control Camera selection, tour sequence, group sequence, group preset, OSD display, Camera/Receiver control via coaxial or RS-485 cable communication, Recorder control
Alarm control	Alarm event, Alarm Acknowledge, Alarm reset, Alarm suspension, Alarm History Display, Timer event, and Camera event
RS-485 (Camera)Port	6-conductor modular jack x 12 (2-wire or 4-wire communication, With termination switches (MODE 1 to 4))
Extension Port	6-conductor modular jack x 2(With a (EXTENSION 1 IN, OUT) termination switch (TERM: ON, OFF))
Extension Port	37-pin D-sub connector x 2(EXTENSION IN 2 or 3)
Extension Port	37-pin D-sub connector x 2(EXTENSION OUT 2 or 3)

## b. Input Board:

Camera Input	1 V [P-P]/75 Ohm (BNC), composite video signal 0.5 V [P-P]/75 Ohm data signal and 2.5 V [P-P]/75 Ohm (25 pin D sub connector x 4)
Alarm Input	N.O. (Normally Open contact) or N.C. (Normally Close contact) selectable x 32 (37 pin D sub connector)

## c. Output Board:

Monitor Output	1 V [P-P]/75 Ohm (BNC)
Alarm Output	Open collector output x 32, Max. 24 VDC, 100 mA
Extension Port	6-conductor modular jack x 2
Serial Port	9-pin D-sub connector x 2

## 6. Network Server:

- a. Allow for transmission of live video, data, and audio over existing Ethernet network or dedicated security system network, requiring IP address or Internet Explorer 5.5 or higher, or work

- as analog-to-Ethernet "bridge" controlling matrices, multiplexers, and pan/tilt/zoom cameras. Network to operate in box-to-box configuration allowing for encoded video to be decoded and displayed on analog monitor.
- b. If CCTV System network will be utilized as primary means of monitoring, operating, and recording cameras then the following equipment will be required:
    - 1) System Server.
    - 2) Computer Workstation.
    - 3) Recording Device.
    - 4) Encoder/Decoder.
    - 5) Monitor.
    - 6) Hub/Switch.
    - 7) Router.
    - 8) Encryptor.
  - c. Servers to provide overall control, programming, monitoring, and recording of cameras and associated devices within CCTV System.
  - d. Equipment on network to be IP addressable.
  - e. CCTV System network is required to meet or exceed the following design and performance specifications:
    - 1) Two MPEG-4 video streams for total of 40 images per second.
    - 2) PC Software that manages installation and maintenance of hardware transmitters and receivers on network.
    - 3) Video Source that supports NTSC video source to computer network will be addressed.
    - 4) Receivers used to display video on standard analog NTSC or PAL monitor will be addressed.
  - f. System supporting the following network protocols:
    - 1) Internet connections: RTP, Real Time Control Protocol (RTCP), UDP, IP, TCP, ICMP, HTTP, Simple Network Management Protocol (SNMP), IGMP, DHCP, and ARP.
    - 2) Video Display: MPEG-4, M-JPEG in server push mode only.
    - 3) Have ability to adjust bandwidth, image quality and image rate.
    - 4) Support image sizes of 704 by 576 pixels or 352 by 288 pixels.
    - 5) Have audio coding format of G.711 or G.728.
    - 6) Provide video frame rate of minimum 30 images per second.

- 7) Support LAN Interface Ethernet 10/100BaseT and be auto sensing.
- 8) Have LAN Data Rate of 9.6 Kbps to 5.0 Mbps.
- 9) Utilize data interface RS-232/RS-422/RS-485.
- g. All connections within system to be via CAT-V cable and RJ-45 jacks. If analog equipment is used as part of system, then encoder or decoder will be utilized to convert analog signal to digital one.
- h. CCTV network system to conform to all VA agency wide security standards for administrator and operator use.
- i. Server Technical Characteristics:

Hardware	Personal Computer
CPU	Pentium IV, 3.0 GHz or better
Hard Disk Interface	IDE or better
RAM	256 MB
OS	Windows XP Home/XP Professional
Graphic Card	NVIDIA GeForce 6600 NVIDIA Quadro FX 1400 ATI RADEON X600/X800 or better
Ethernet Card	100 Mb
Software	DirectX 9.0c
Free Memory	120 MB

- j. Network Switch Technical Characteristics:

Protocol and standard	IEEE802.3 IEEE802.3u IEEE802.3ab
Ports	24 10/100/1000M auto-negotiation RJ-45 ports with auto MDI/MDI-X
Network media	Cat 5 UTP for 1,000Mbps Cat 3 UTP for 10Mbps
Transmission method	store-and-forward
LED	indicator power, act/link, speed

- k. Router Technical Characteristics:

Network Standards	IEEE 802.3, 802.3u 10Base-T Ethernet (WAN) 100Base-T Ethernet (LAN) IEEE 802.3x Flow Control IEEE802.1p Priority Queue ANS/IEEE 802.3 NWay auto-negotiation
Protocol	CSMA/CD, TCP, IP, UDP, PPPoE, AND DHCP (client and server)
VPN Supported	PPTP, IPsec pass-through
Management	Browser
Ports	4 x 10/100Base-T Auto sensing RJ45 ports, and an auto uplink RJ45ports 1 x 10Base-T RJ45 port, WAN
LEDs	Power, WAN Activity, LAN Link (10/100), LAN Activity

1. Encryptor Technical Characteristics:

Cryptography	Standard - Triple DES 168-bit (ANSI 9.52) Rijndael - AES (128, 192, 256)
Performance	Throughput (end-to-end) @ 100 Mbps line speed: greater than 188 Mbps full duplex (large frames) greater than 200 kfps full duplex (small frames) Latency (end-to-end) @ 100 Mbps
Key Management	Automatic KEK/DEK Exchange Using Signed Diffie-Hellman Unit Authentication Using X.509 Certificates
Physical Interfaces	10BaseT or 10/100BaseT Ethernet (Host and Network Ports) 10BaseT Ethernet Management Port Back and Front-Panel Serial Control Port
Device Management	THALES Element Manager, Front Panel Viewer, and Certificate Manager 10Base T (RJ-45) or 9-pin Serial Control Port SNMP Network Monitoring

Cryptography	Standard - Triple DES 168-bit (ANSI 9.52) Rijndael - AES (128, 192, 256)
Security Features	Tamper Proof Cryptographic Envelope Tamper Evident Chassis Hardware Random Number Generator
Management	Channel Encrypted Using Same Algorithm as Data Traffic
Security Certifications	FIPS 140-2 Level 3 CAPS Baseline and Enhanced Grades Common Criteria EAL4 and EAL5 (under evaluation)
Regulatory	EN60950, FCC, UL, CE, EN 50082-1, and EN 55022

## 2.8 RECORDING DEVICES

- A. Cameras on CCTV System to be recorded in real time using Digital Video Recorder (DVR), Network Video Recorder (NVR), or Time Lapse Video Recorder (VCR). Type of recording device utilized to be determined by size and type of CCTV System designed and installed, and to what extent system is to be utilized.
- B. Provide rack-mounted recording devices.
  1. Size: 47.5 cm (19 inch).
- C. DVR's and NVR's viewable over Intranet or Internet will be routed through encryptor meeting the following requirements:
  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 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.

## D. Digital Video Recorder (DVR):

1. Ability to record video to hard drive-based digital storage medium in NTSC or MPEG format and meet the following minimum requirements:
  - a. Record at minimum 30 images per second (IPS).
  - b. Have minimum eight (8) to 16 looping inputs.
  - c. Have minimum eight (8) to 16 alarm inputs and two (2) relay outputs.
  - d. Provide instantaneous playback of recorded images.
  - e. IP addressable, if part of CCTV network.
  - f. 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 six-month history that tracks all events related to alarm; specifically who, what, where and when.
  - i. DVR management capability providing automatic video routing to back-up spare recorder in case of failure.
  - j. Accessible locally and remotely via Internet, Intranet, or personal digital assistant (PDA).
  - k. Records all alarm events in real time, ensuring 60 seconds before and after event are included in recording.
  - l. Utilize RS-232 or fiber optic connections for integration with SMS computer station via remote port on network hub.
  - m. Allow for independently adjustable frame rate settings.
  - n. Compatible with matrix switcher utilized to operate cameras. DVR could be utilized as matrix switcher only if it meets all requirements listed in matrix switcher section.
  - o. Technical Characteristics:

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



Processor	Intel Pentium III 750 MHz
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

2. Network Video Recorder (NVR):

- a. Ability to record video to hard drive-based digital storage medium in MPEG format and meet the following minimum requirements:
- 1) Record at minimum 30 IPS.
  - 2) Have minimum eight (8) to 16 looping inputs.
  - 3) Have minimum eight (8) to 16 alarm inputs and two (2) relay outputs.
  - 4) Provide instantaneous playback of all recorded images.
  - 5) IP addressable, if part of CCTV network.
  - 6) Built-in digital motion detection with masking and sensitivity adjustments.
  - 7) Easy playback and forward/reverse search capabilities.
  - 8) Complete audit trail database, with minimum six-month history tracking all events related to alarm; specifically who, what, where and when.
  - 9) NVR management capability providing automatic video routing to back-up spare recorder in case of failure.
  - 10) Accessible locally and remotely via Internet, Intranet, or personal digital assistant (PDA).

- 11) Records all alarm events in real time, ensuring 60 seconds before and after event are included in recording.
- 12) Utilize RS-232 or fiber optic connections for integration with SMS computer station via remote port on network hub.
- 13) Allow for independently adjustable frame rate settings.
- 14) Be compatible with matrix switcher utilized to operate cameras.

b. 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 VIDOS or 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 VIDOS over 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

3. Time Lapse Video Recorder (VCR):
- a. Ability to be specifically designed as time lapse recorder within CCTV System meeting the following minimum requirements:
- 1) Allow for repeat recording.
  - 2) Allow for series recording with multiple recorders.
  - 3) Able to record Daily/Weekly/Holiday schedules.
  - 4) Jog/Shuttle for easy forward or reverse field playback.
  - 5) Search using alarm index, time and date, skip, counter memory stop.
  - 6) Built in time and date generator that can be turned on and off, and impose time and date on video during recording.
  - 7) Built in alarm that annunciates end of tape, excessive condensation, transport malfunction, or tape jam.
  - 8) On-screen programming.
  - 9) Interface with matrix switcher.
  - 10) Automatic head cleaning.
  - 11) Battery backup for internal settings.
  - 12) Tape use counter.
  - 13) Daylight saving time setting.
- b. Video tape used in recorder to meet the following requirements:
- 1) Contained in cassette mechanism.
  - 2) Self-loading and not require operator to thread tape.
  - 3) Load through front of recorder.
  - 4) Labeled with date and times of coverage.
  - 5) Stored for minimum period specified in VA CCTV standards.
- c. Locally installed at monitoring station.
- d. Technical Characteristics:

Tape Format	Standard 13 mm (1/2 inch) VHS
Video Recording Standard	6/8 Hour in NTSC
Time Lapse Recording	18/30/54/78/102/126/174 or 24/40/72/104/136/160/232 hour
Video Recording System	Rotary 2-head azimuth
Video Head Configuration	4-head double azimuth Tape Transport
Rewind/FF Speed	Within 120 seconds (with T-120 VHS tape)
Head Cleaning	Automatic

Tape Format	Standard 13 mm (1/2 inch) VHS
Record/Playback	Time Mode (EP) 6H, L18H, L30H, 48H, 72H, 96H, 0H
Horizontal Resolution	(SR Mode) 400 lines (VHS Mode) 240 lines
Video Input/Output	(BNC) 1.0 Vp-p, 75 Ohm
Audio System Record/Playback	6H, L18H, L30H
Timer Recording	8 event programmability
Display	Month/Day/Year and Time

## 2.9 WIRES AND CABLES

### A. General Requirements:

1. Wires and cables to meet or exceed manufacturer's recommendation for power and signal.
2. Carried in enclosed conduit system, utilizing electromagnetic tubing (EMT) to include equivalent in flexible metal, rigid galvanized steel (RGS) to include equivalent of liquid tight, polyvinylchloride (PVC) Schedule 40 or 80.
3. Conduits to be sized and installed according to NFPA 70. Security system signal and power cables that traverse or originate in high security office space to be contained in EMT or RGS conduit.
4. Conduit, pull boxes, and junction boxes to be marked with colored permanent tape or paint that allow it to be distinguished from other conduit and infrastructure.
5. Conduit fills not to exceed 50 percent, unless otherwise documented.
6. Pull string to be pulled along and provided with signal and power cables to assist in future installations.
7. Apply firestopping materials at locations where there is wall penetration or core drilling is conducted for conduit installation.
8. Do not place high voltage and signal cables same conduit and keep separate up to connection point. High voltage for security system is defined as any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For equipment carrying digital data between Access Control System and Database Management or at remote monitoring station, provide minimum 20 AWG and stranded copper wire for each conductor. Cable or each individual conductor within cable to have shield that provides

100 percent coverage. Cables with single overall shield to have tinned copper shield drain wire.

10. Cables and conductors, except fiber optic cables, that act as control, communication, or signal lines to include surge protection. Provide surge protection at equipment end and additional triple electrode gas surge protectors rated for application on each wire line circuit to be installed within 1 m (3 ft.) of building cable entrance. Test inputs and outputs in both normal and common mode using the following wave forms:
  - a. 10 microsecond rise time by 1000 microsecond pulse width waveform with peak Voltage of 1500 volts and peak current of 60 Amperes.
  - b. 8 microsecond rise time by 20 microsecond pulse width wave form with peak Voltage of 1000 Volts and peak current of 500 Amperes.
  - c. Prevent surge suppression device from attenuating or reducing video or sync signal under normal conditions. Do not use fuses and relays for surge protection.

B. Coaxial Cables:

1. Provide coaxial cables for video signal cables for CCTV System, except to PoE cameras that have characteristic impedance of 75 ohms plus or minus 3 ohms.
2. For runs up to 230 m (750 feet), use of RG-59/U is required. RG-59/U to be shielded which provides minimum 95 percent coverage, with stranded copper center conductor of minimum 23 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
3. For runs between 230 m and 380 m (750 feet and 1250 feet), RG-6/U is required. RG-6/U to be shielded which provides minimum 95 percent coverage, with stranded copper center conductor of minimum 18 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
4. For runs of 380 m to 840 m (1250 to 2750 feet), RG-11/U is required. RG-11/U to be shielded which provides minimum 95 percent coverage, with stranded copper center conductor of minimum 14 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
5. All runs greater than 840 m (2750 feet) will be with fiber optic cable. Utilize the following equipment if using fiber optics as signal carrier:

- a. Multimode fiber optic cable minimum 62 microns.
  - b. Video transmitter, installed at camera that utilizes 12 Volt DC or 24 Volt AC for power.
  - c. Video receiver, installed at 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	3.7 mm (0.145 inches)
Outer Shield Type	Braid/Braid
Outer Jacket Material	PVC
Overall Nominal Diameter	6 mm (0.242 inches)
UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.094 $\mu$ H/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	4.5 mm (0.180 inches)
Outer Shield Material	Trade Name Duofoil

AWG	18
Outer Shield Type	Tape/Braid
Outer Shield %Coverage	100 percent
Outer Jacket Material	PVC
Overall Nominal Diameter	7 mm (0.274 inches)
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.106 $\mu$ H/ft
Nom. Capacitance	Conductor to Shield 16.2 pF/ft
Nom. Velocity of Propagation	82 percent
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	1.6 mm (0.064 inches)
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	8 mm (0.312 inches)
Inner Shield Type	Braid
Inner Shield Material	BC - Bare Copper
Inner Shield %Coverage	95 percent
Inner Jacket Material	PE - Polyethylene
Inner Jacket Diameter	10 mm (0.391 inches)
Outer Shield Type	Braid
Outer Shield Material	BC - Bare Copper
Outer Shield %Coverage	95 percent
Outer Jacket Material	Trade Name Belflex
Outer Jacket Material	PVC Blend

AWG	15
Overall Nominal Diameter	13 mm (0.520 inches)
Operating Temperature Range	-35°C To +75°C
Non-UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.097 $\mu$ H/ft
Nom. Capacitance	Conductor to Shield 17.3 pF/ft
Nom. Velocity of Propagation	78 percent
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

C. Signal Cables:

1. Signal wiring for PoE cameras depends on distance camera is being installed from hub or server.
2. If camera is up to 90 m (300 ft.) from hub or server, provide shielded UTP category 5 (CAT-V) cable with standard RJ-45 connector at each end. Cable to comply with Power over Ethernet, IEEE802.3af, Standard.
3. If camera is over 90 m (300 ft.) from hub or server, provide multimode fiber optic cable, minimum 62 microns.
4. Provide separate cable for power.
5. 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	6 mm (0.230 inches)
IEC Specification	11801 Category 5



Number of Pairs	4
TIA/EIA Specification	568-B.2 Category 5e
Max. Capacitance Unbalance	(pF/100 m) 150 pF/100 m
Nom. Velocity of Propagation	70 percent
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 percent
Max. Operating Voltage	UL 300 V RMS

6. Fiber Optic Cables Technical Characteristics:

Fiber Type	62.5 Micron
Number of Fibers	4
Core Diameter $\mu$	2.5 +/- 2.5 microns
Core Non-Circularity	5 percent Maximum
Clad Diameter $\mu$	125 +/- 2 microns
Clad Non-Circularity	1 percent Maximum
Core-clad Offset	1.5 Microns Maximum
Primary Coating Material	Acrylate
Primary Coating Diameter $\mu$	245 +/- 10 microns
Secondary Coating Material	Engineering Thermoplastic
Secondary Coating Diameter $\mu$	900 +/- 50 microns
Strength Member Material	Aramid Yarn
Outer Jacket Material	PVC
Outer Jacket Color	Orange
Overall Diameter	5 mm (0.200 inches)
Numerical Aperture	.275
Maximum Gigabit Ethernet	300 meters (985 feet)
Maximum Gigabit Ethernet	550 meters (1804 feet)

D. Power Cables:

1. Sized accordingly and complying with NFPA 70. High Voltage power cables to be minimum three conductors, 14 AWG, stranded, and coated with non-conductive polyvinylchloride (PVC) jacket. Low Voltage cables to be minimum 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.

2. Power cables to be provided for all CCTV System components that require 110 Volt AC 60 Hz or 220 Volt AC 50 Hz input. Connect each feed to dedicated circuit breaker at security system power panel.
3. Protect equipment connected to AC power from surges. Equipment protection to withstand surge test waveforms described in IEEE C62.41. Fuses are not acceptable for surge protection.
4. Provide power supplies rated for 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).
5. Low Voltage Power Cables:
  - a. Minimum 18 AWG, stranded with polyvinylchloride outer jacket.
  - b. Determine cable size by basic voltage over distance calculation and comply with NFPA 70 requirements for low Voltage cables.

### **PART 3 - EXECUTION**

#### **3.1 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. Install systems according to NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.

#### **3.2 INSTALLATION - EQUIPMENT**

SPEC. WRITER NOTE: Edit paragraph and sub-paragraphs to apply only to the equipment and devices that are being installed.

- A. Configure components with appropriate service points to pinpoint system trouble in less than 30 minutes.
- B. Install system components, including Government furnished equipment, and appurtenances according to manufacturer's instructions, and provide necessary connectors, terminators, interconnections, services, and adjustments required for complete and operable system.
- C. Cameras:
  1. Install cameras with focal length lens as indicated for each zone.
  2. Connect power and signal lines to cameras.

3. Set cameras with fixed iris lenses to f-stop to give full video level.
4. Aim camera to give field of view as required to cover alarm zone.
5. Aim fixed mounted cameras installed outdoors facing rising or setting sun sufficiently below horizon to preclude camera looking directly at the sun.
6. Focus lens to give sharp picture (to include checking for day and night focus and image quality) over entire field of view; and synchronize all cameras so picture does not roll on monitor when cameras are selected. Dome cameras to have all preset positions defined and installed.

D. Monitors:

1. Install monitors as shown and specified in construction documents.
2. Connect signal inputs and outputs as shown on drawings and specified.
3. Terminate video input signals as required.
4. Connect monitor to AC power.

E. Switcher:

1. Install switcher as shown in construction documents and according to OEM.
2. Connect subassemblies as specified by manufacturer and as shown on drawings.
3. Connect video signal inputs and outputs as shown on drawings and specified; terminate video inputs as required.
4. Connect alarm signal inputs and outputs as shown on drawings and specified; connect control signal inputs and outputs for ancillary equipment or secondary control/monitoring sites as specified by manufacturer and as shown on drawings.
5. Connect switcher CPU and switcher subassemblies to AC power.
6. Load all software as specified and required for operational CCTV System configured for site and building requirements, including data bases, operational parameters, and system, command, and application programs.
7. Provide original and two copies of accepted software on successful completion of endurance test.
8. Program video annotation for each camera.

F. Video Recording Equipment:

1. Install video recording equipment as shown in construction documents, and as specified by OEM.
2. Connect video signal inputs and outputs as shown on drawings and specified.
3. Connect alarm signal inputs and outputs as shown on drawings and specified.
4. Connect video recording equipment to AC power.

G. Video Signal Equipment:

1. Install video signal equipment as shown in construction documents, and as specified by OEM.
2. Connect video or signal inputs and outputs as shown on drawings 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.

H. Camera Housings, Mounts, and Poles:

1. Install camera housings and mounts as specified by manufacturer and as shown on drawings. Provide mounting hardware sized appropriately to secure each camera, housing and mount for maximum wind and ice loading encountered at site.
2. Provide foundation for each camera pole as specified and shown on drawings.
3. Provide ground rod for each camera pole and connect camera pole to ground rod as specified in Division 26 Sections and VA Electrical Manual 730.
4. Provide electrical and signal transmission cabling to mount location via hardened carrier system from Access Control System and Database Management to device.
5. Connect signal lines and AC power to housing interfaces.
6. Connect pole wiring harness to camera.

### 3.3 TRAINING

- A. The Contractor will provide training. The training method shall agree with the precepts of an accepted training methodology such as the Systems Approach to Training that is used by the DoD. No Ad Hoc training will be considered acceptable. Student(s) will be provided printed training materials as well as a CD/DVD copy of the classes. The training must provide the student(s) the ability to: set up the system,

maintain the system, trouble shoot problems, recognize system/component failures as well as any nuanced customization of the system for the specific location.

B. Training on each installed system [IE components] will minimally include:

1. CCTV
  - a. Management of Recording Devices
  - b. Trouble shooting cameras (Basic understanding)
  - c. Search/Obtain Video Recordings
    - 1) How to isolate and capture videography for exportation to both a portable device/disk/server file
  - d. Video Analytics

WRITER NOTE: Provide Visitor Management System training if installed.

2. Visitor Management
  - a. Management of Visitor Management tools
3. Overall system(s) maintenance.
  - a. Those steps necessary for the basic understanding of: lifecycle maintenance of system to include factors such as: yearly support agreements, impact of power surges/loss as well as those endemic pieces of knowledge that include preventive maintenance considerations and or tasks.

C. The contractor will provide instruction giving the students sufficient training to be able to effectively operate the system and recognize problems as they arise. All training must include guided practical application exercises to ensure student(s) understanding. Certification of the training/curriculum/rosters will be provided to the COR/CO upon training task completion.

- - - E N D - - -