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Overview of Electrical Engineering for School Design (Live Webinar)

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SECTION 16783

CAMERAS AND CABLING FOR VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Furnish and install cameras, equipment racks and cabinets, patch panels and wiring for the network based Video Surveillance System. The work shall consist of, but not be limited to the following:

1. Analog **Dome** Fixed Cameras
2. Analog Dome PTZ Cameras
3. CCTP cabling infrastructure for video, power and control signaling.
4. CCTP Category 6 compliant patch panels
5. Equipment racks, cabinets and associated hardware
6. Console for Viewing Station

1.02 SUPPLEMENTAL SUBMITTALS

A. Shop Drawings:

1. The wiring and schematic diagrams of the wiring system as proposed to be installed.

2. Coordinated rack/cabinet plans and elevations of main equipment room and each telecommunications closets identifying the locations, dimensions of all terminating hardware provided by this contractor.

3. Photographs of proposed cameras mounting location (marked on wall or ceiling) and their respective field of view.

B. Product Data:

Catalog sheets, specifications and installation instructions for all products.

C. Sample:

1. CCTP Category 6e Cable.
2. Cable connector

D. Mounting details for typical **indoor/outdoor** fixed and **PTZ** cameras.

E. Certificate of compliance with the Quality Assurance and Maintenance requirements.

F. Warranty.

G. Operation and Maintenance Manuals, including a single line riser diagram in paper and electronic form of the installed work, including interconnection of all equipment and cabling requirements. Line diagrams required are to be submitted in the following acceptable electronic format: AUTOCAD or Visio (VSD) diagram format.

H. Test results and certificate of completion of testing.

I. Qualification of authorized installer of CCTP Category 6 cable.

J. Training

1.03 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract apply to work of this section.

B. The following section apply to Work of this section:

Section 07270 - Firestopping

1.04 REFERENCES

A. The publications listed form a part of this specification to the extent referenced. All publications to be the most current editions unless otherwise noted.

1. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
   a) NFPA-70 National Electrical Code

2. ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
   a) EIA-170 Electrical Performance Standards
   b) EIA-310C Racks, Panels and Associated Equipment

3. UNDERWRITERS LABORATORIES (UL)
   a) UL-3044 Standards for Surveillance Closed Circuit Television Equipment
   b) UL-2044 Standard for Commercial CCTV Equipment and Power Supplies
   c) UL-1492 Standard for Audio-Video Products including CCTV Monitors
   d) UL-60065 Safety Requirements for Audio, Video and similar Electronic Apparatus

4. TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

a) TIA-EIA 568-B.2.1 Transmission Performance Specifications for 4-Pair 100 Ohm Category 5e and Category 6 Cabling

b) TIA-EIA 568-B Series Commercial Building Telecommunications Cabling Standard

c) ISO/IEC 11801 Category 6 cable

1.05 QUALITY ASSURANCE

A. The manufacturers of cameras, cabling, and related mounting equipment shall have been in the market for a period of no less than five (5) years.

B. All equipment shall be UL listed and shall have FCC certification where appropriate.

C. The system shall be durable and designed for continuous operation.

1.06 WARRANTY

A. As specified in paragraph 1.07 AUTHORIZED INSTALLER FOR CCTP.

1.07 AUTHORIZED INSTALLER FOR CCTP

A. The contractor shall obtain services of a company acknowledged in business as an AUTHORIZED INSTALLER FOR CCTP herein referred to as "AI".

B. The role of the AI in this project shall be to provide video cameras and wiring equipment listed in this section to the Electrical Contractor for installation. The AI shall coordinate delivery schedules and installation of equipment with the system integrator and related trades. Additionally, the AI shall be responsible for all documentation for equipment in this section, Cabling record drawings and final testing of the cabling system

C. The AI shall have experience in the operation and installation of similar equipment associated with the construction and/or renovation of facilities similar in scope to this project.

D. The AI shall have been in business for a minimum of 5 consecutive years. The AI shall not have been barred from doing business with any City, State or Federal

agency and shall have no current pending actions which may lead to such disbarment.

E. **The office of the AI shall be located within 50 miles of the job-site. The AI shall be capable of providing all engineering support and on-site supervision throughout the project. The AI shall be authorized by the manufacturer to provide warranty repair and service after acceptance. The AI shall submit all documentation required to activate the following manufacturer's warranties:**

1. Three years parts and labor on all CCTP components.

2. Three years parts only on cameras and camera housings.

F. **The AI shall supplement the manufacturer's warranties with a one-year labor warranty on cameras installations pursuant to General Condition 17.01.**

G. **Any warranty repairs will be coordinated by the Video Surveillance System Support Team at DOE's Division of Instructional and Information Technology (DIIT).**

H. **The AI shall perform a video field survey, utilizing the proposed camera and a lab-top computer to establish the optimal location of the cameras to obtain the designated field of view. AI shall submit a copy this field of view utilizing a video recorder and frame capture device along with the camera shop drawings to the engineer of record for approval.**

I. Authorized installer for CCTPs:

1. ADT Security Services, Inc.
2. A+ Technology Solutions, Inc.
3. IBM Global Services
4. IDESCO Corp.
5. Meridien Associates, Inc.
6. Henry Bros. Electronics, Inc.
7. Nortronics Corp.
8. CG Atlantic
9. Diebold Enterprise Security Systems
10. **Champion Alarm Systems**
11. **Artel Communication**
12. **Fire Systems, Inc.**

J. Included in the qualification documentation package will be a statement that:

1. AI has been in business for a continuous period of at least five (5) years.

2. AI maintains factory certifications on all proposed equipment.

3. AI is an Authorized Installer for CCTP.

1.08 COORDINATION WITH SYSTEM INTEGRATOR FOR DATA LAN NETWORK

The Division 16 Contractor and AI shall be available during LAN and video surveillance equipment (i.e. wiring switches, video encoders, server, and viewing stations) installation and testing and assist school-wide LAN computer integrator to isolate and remedy faults that may exist in the cabling system installation and cameras operation.

Contractor shall coordinate with the school-wide LAN/Video Surveillance system integrator and assist the integrator during two (2) four-hour training sessions.

1.09 SYSTEM DESCRIPTION

A. The system will consist of standard analog color cameras, suitable for the application and the location being used. Analog video signals from the cameras will be transmitted to the nearest building telecommunication closet Intermediate Distribution Frame (IDF) via unshielded twisted pair cabling (UTP), also known as Closed Circuit Twisted Pair (CCTP). All necessary camera interface devices/equipment (such as impedance matching, signal breakout, and converter apparatus) shall be supplied as part of the work.

B. Exterior mounted cameras shall be capable of automatically switching from color mode (daytime usage) to low-light sensitivity, black and white (nighttime usage).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Approved manufacturers are:

A. Cameras:
   1. **Panasonic**
   2. Bosch **(PTZ only)**
   3. **Sony**
   4. **Pelco**

B. Video Over Twisted Pair Terminating and Transmitter/Receiver equipment:
   1. Anixter CCTP

C. Wiring: Video Over Twisted Pair Cable: Anixter CCTP technology.

D. **The specification enumerates technical detail and characteristics of each camera followed by a model number. The selected camera must meet all the characteristics described in the specification.**

2.02 INDOOR AND OUTDOOR DOME FIXED CAMERA

The camera will operate at 0.1-lux low light sensitivity, along with automatic electronic shutter, and automatic gain control. The camera shall be capable of capturing color images at 1.0 lux lighting and revert to capturing monochrome images under .1 lux lighting conditions. The camera must support the use of direct current (DC) type or Video-type auto iris lenses.

The camera shall be a ¼ inch (minimum) CCD which produces a minimum of 480 TV line with a signal to noise ratio of 50dB or better (weighted measurement with Automatic Gain Control (AGC) off) and active pixel count of 768(H) X 494 (V) (approximately 39,000 pixels).

The camera shall provide line/self lock or Gen lock for "roll-free" switching and must operate on 10 to 40 VDC or 18 to 30 VAC source. The camera must provide Automatic Backlight Compensation (**with four to** eight selectable windows) and Automatic White Balance Monitoring **or Auto Trace White (for color mode only). Monitoring** of lobbies and entrances, outdoor areas, or any low light applications shall utilize the Wide Dynamic camera that automatically applies correct exposure patterns to bright and normal areas. The camera automatically switches from accurate color images in daylight to clear, high-resolution monochrome images in low light conditions (down to 0.3 lux).

The camera shall operate to full specifications within the normal temperature range of **-20°** to 50°C (-4° to 122°F).

Varifocal lens shall be 2.9 mm to 8.0 mm. **For areas that require wide angle lens applications (e.g. for stair landings), use a 2.0 mm or 2.2 mm wide angle lens or others appropriate lens suitable for the application without causing distortion to the live or archive picture. For application requiring field of view beyond 50 feet (long corridor), use varifocal lens 5.0-50mm.**

All fixed cameras shall be provided with rugged, high impact and vandal resistant enclosure and Ingress Protection of 66 (IP66) to insure dust and water tightness

with tamper proof security screws. The camera body shall have ¾" thread for direct connection with a conduit pipe.

The camera shall be a **Sony Model SSCCD73V or Panasonic Model WV-CW474AS.**

2.03 INDOOR AND OUTDOOR PTZ DOME CAMERA

The dome assembly shall be comprised of a high-speed pan/tilt assembly, high-resolution color, **preferably the camera shall have a range of zoom from 10X to 18X optical and 4X digital zoom.** The lens shall pause at **optical** magnification, then enter digital zoom mode. The camera/lens assembly shall provide for continuous, full-time auto focus **at any angle or distance.** No matter what the zoom position, the dome's images shall remain in sharp focus. The dome shall return to automatic focus/iris mode when the operator moves the pan/tilt assembly more than ten degrees. **The camera shall follow the guidelines in the previous section of fixed dome cameras with ¼ inch CCD with minimum of 480 TV lines of horizontal resolution and a signal to noise ratio of 48dB or better.**

The color camera shall provide sharp, detailed images down to 1.0-lux color, and down to 0.7-lux in color integration mode (50 IRE, AGC on). The color/mono camera shall provide sharp, detailed images down to 1.0-lux. It shall automatically switch to **B&W** mode and provide sharp detailed images down to 0.1-lux mono, and 0.01-lux mono integration (50 IRE, AGC on). **Line-lock, Gen lock or self lock shall be provided.** The lens shall be a color corrected, 4.1-73.8 mm, F1.4, spherical, and shall have continuous auto focus with manual override **with ATW (Auto trace white) or AWB (Auto white Balance).** The **PTZ** dome shall automatically adjust pan and tilt speeds in proportion to zoom position for greater control.

The dome shall support **4 to 64** programmable preset positions. Each preset position shall include pan, tilt, zoom, iris, and focus settings. The dome shall support **mimic tours of 2 or more.** The dome shall incorporate automatic 180-degree flip circuitry, with the ability for the operator to turn ON or OFF. When this feature is ON, the dome shall automatically turn 180 degrees when reaching its lower tilt limit. This allows the operator to automatically track objects moving directly below the camera. The dome shall also support a home position that automatically returns the dome to a programmed preset, or tour, after a specified period of inactivity.

The dome shall be configurable to provide either RS 422 or RS485. The receiver/driver will provide all voltages for camera controls pan and tilt functions, and all motorized lens functions.

The complete dome assembly shall be capable of operating to full specification with an applied voltage of 24 VAC at a frequency of 60 Hertz, and shall meet Class 2 standards. The power consumption shall not exceed 40 watts for indoor versions with all functions operating. The dome assembly shall have transorbs with optical isolation to protect the RS422 circuitry. The **PTZ** domes shall be provided with the correct mounting configurations to suit the application. The mounting assemblies shall be designed to be simple to install and allow for easy installation and removal of the dome camera and controls.

All cameras shall be provided with rugged, high impact and vandal resistant housing with tamper proof security screws (including all types of mounting housing or bracket) **high impact resistance, and Ingress Protection rated at IP66 or higher.**

The **outdoor PTZ dome camera** version shall be available in a wide range of versatile mounting configurations. Configurations shall include Wall, Pole/Flat Roof, and Soffit mounts. The environmental mounts shall include a twisted pair passive module included as standard, allowing for unshielded twisted pair (UTP) video transmission with the appropriate receiver.

All **PTZ** dome **cameras** shall include an inner liner with clear outer bubble, resulting in no **and/or low** light loss. Each dome will include diagnostic LED's to indicate power and communications from the controller. The dome assembly design shall contain eight **2** alarm inputs and 2 **alarm** outputs.

All PTZ outdoor cameras shall be provided with integrated housing with heater and blower, complete with mounting hardware and brackets. The cameras shall be corner mounted, but not higher than the second floor level of any building structure, unless otherwise directed by the Authority at the site.

The environmental camera shall be a Bosch Envirodome Model ENVD2460W **or Panasonic WV-CW864A/964.**

2.04 CCTP CABLING INFRASTRUCTURE FOR VIDEO, POWER, AND CONTROL SIGNALLING

The test standards shall apply to all connecting elements within the infrastructure system that enables the completed "link" or "channel", inclusive of video outlets (jacks), patch panels, and connector plugs. The "link" (horizontal cabling from closet to camera) shall not exceed 90 meters (308 feet) in length.

A. CCTP category 6 cable

1. The horizontal distribution cabling shall be a bonded four (4) pair, unshielded twisted pair (UTP) design contained in a crescent shaped outer sheath as used for voice and data communications.

2. This cable shall have been tested and met all testing to be compliant to a minimum Category 6 rating, based upon TIA standards.

3. The conductors will be solid copper.

4. The insulation of will be PVC for non-plenum areas and 100% FEP for plenum areas.

5. This cable shall possess the ratings by UL (Underwriter's Laboratory) of CMR/CMP and DP3/DP3P as applies to the cable type and insulation.

6. This cable shall have been sweep tested to 400 Mhz.

7. The cable shall have a sheath of a bright orange color to differentiate it from other horizontal distribution cabling.

8. The cable shall be a product of the CCTP system, as distributed by Anixter, Inc. Model CM-422-7b-08-CCTP for PVC jacket, or Model CMP-422-7b-08-CCTP for FEP plenum jacket.

B. CCTP Category 6 Patch Panel

1. The patch panel for the horizontal distribution cabling shall be IDC (insulation displacement connection) in the 110 format on its backside and RJ45 interface (orange) on its front side.

2. The patch panel shall have been tested and have met all testing to be compliant to a minimum Category 6 rating, based upon the TIA standards.

3. The patch panel shall meet the following optimum characteristics resulting from testing:

Pair-to-pair NEXT loss @ 100 Mhz	54 dB
Pair-to-pair FEXT loss @ 100 Mhz	43.1 dB
Power Sum NEXT loss @ 100 Mhz	50 dB
Power Sum FEXT loss @ 100 Mhz	40.1 dB
Connector attenuation @ 100 Mhz	0.20 dB
Connector return loss @ 100 Mhz	24.0 dB

4. The patch panel shall be a product of the CCTP system, as distributed by Anixter, Inc. Model 16P6-CCTP for 16-port, or Model 32-P6-CCTP for 32-port.

C. CCTP Category 6-Jacks

1. The jacks shall be in the configuration of RJ45 with 110 IDC cable termination. They shall meet Category 6 or greater testing standards and be color coded orange to identify as camera outlets.

2. The jacks shall be a product of the CCTP system, as distributed by Anixter, Inc. Model JCK6-CCTP with a matching face plate Model 01-FP-CCTP.

D. Camera Interface Adapter Cord

The camera interface adapter cord shall be designed to be attached to the camera cable, terminated with a 110 to RJ45 jack, via RJ45 plug. The interface shall be configured to accept the designated pair for the video signal from twisted pair cabling and convert same to 75 ohm coaxial cable with BNC plug for camera connection, while passing the remaining pairs through to the camera for power and/or control. The cord type interface shall be Anixter model VDP-(12, 18, 36)-01-2-CCTP for 12", 18", and 36" lengths or approved equal.

E. Camera Interface Enclosure:

The camera interface enclosure shall be **an FS** box with tamper resistant screws. They shall be products of the CCTP system, as distributed by Anixter, Inc., with the Model 664 series enclosures or approved equal.

F. Surge Protectors for Exterior Cameras-copper Cable

1. The system protective devices shall provide for transient/lightning protection of cameras.
2. This device shall provide for protection across the three primary elements of the system: video signal, power, and control.
3. The device design shall not employ the use of any pair of the horizontal cable for ground source, but shall require a separate ground conductor meeting NEC and TIA standards.
4. This protective device shall be placed both at the camera and the closet ends of the horizontal drops.
5. This protection device shall be a product of the CCTP system, as distributed by Anixter, Inc., Model LLP-170-CCTP.

G. Cable Ties

All cable ties used to support camera CCTP category 6 cabling shall be fire-resistant Velcro type. The support rating of the cable ties used shall be a minimum of twice that of the weight per unit of the cables to be supported. Cable ties shall be deployed every four (4) feet minimum in horizontal cable tray and two (2) feet minimum when fastening cables vertically on wall or rack.

H. Video Recorder and Frame Capture

This device is capable of recording both still screen captures and full motion video and comes with software compatible to Windows XP Professional. Captures image formats are available in JPEG, BMP, TIF, and PCX. Frame capture device shall be as per AVerMedia AverTv CARDBUS MCE or approved equal.

2.05 EQUIPMENT CABINET & RACKS

A. The equipment cabinet shall be made of individual vertical storage racks attached to each other so as to form one unit. Rack should be capable of accommodating all equipment as show on project drawings including equipment provided by system integrator. Cabinet shall be 84"H X 24"W X 36"D size, floor mounted, 19" EIA mounting rails with durable powder coat paint and zinc-plated finishes. The cabinet shall consist of a 16 gauge sturdy, ventilated steel, freestanding **with lockable wheels**. Provide ventilation fans, 6-point power strips, knockouts top and bottom and removable hinged Plexiglas locking door. **The quality of cabinet and its components shall be equal or better than the following:**

Middle Atlantic Full Height Cabinet P/N:MRK-4436-3774M
Middle Atlantic Fan Assembly P/N: MW-10FT
Middle Atlantic 6 outlet power strip P/N: PD-620-NS
Middle Atlantic Cord & Hardware P/N: 550 CFM 115VAC
Great Lakes Sliding Shelf 7206-MT
Guard Hamburger Style for 10" Fan
Middle Atlantic two Bags of 10/32 Screws

B. IDF closet Wall Cabinet (half height cabinet) shall be 16-gauge high quality steel enclosures with 19" mounting rails and double-hinged door with knockouts top and bottom. The Plexiglas door shall open on left or right as per location. Cabinet size shall be 36"H X 24"W X 36"D.

Middle Atlantic Half Height Cabinet P/N: DWR10-

26PD3774M
Middle Atlantic 8 outlet power strip P/N: PD815SC/PD-DWR
Middle Atlantic Equipment Shelf P/N: U317
Middle Atlantic Rear Rails P/N: DWR-RR10
Middle Atlantic Bag of 10/32 Screws

C. **Cabinet shall be as per Great Lakes, MiddleAtlantic, E2 or Rittal Inc.**

2.06 CONSOLE FOR VIEWING STATION

Console, located at the security station or as shown on plans, shall be heavy-duty welded steel with **red oak veneer desktop**, straight line model or angled (L-shaped), as required to suit the site conditions. Finish: Baked enamel Pearl and Dove Grey.

Console shall have smooth rounded edges all around with two (2) file, two (2) desk drawers and **one compartment for the CPU.** It shall consist of desktop writing surface, **have a space for two 20" flat screen monitors (N.I.C.)** lockable tilted racks **with Lexan protective screens** for the monitors, space for Pan/Tilt/Zone controls, power supplies, and other related equipment. **The console must be coordinated with Authority system integrator and assembled on-site under the supervision of the manufacturer. Console shall be Russ-Bassett, Middle Atlantic or approved equal.**

2.07 EXTERIOR CAMERA POWER SUPPLY

Power supplies for exterior camera **heaters/blowers** (not remotely powered by CCTP Chassis Power Supply) shall be UL listed, a product of Altronix ATLV244-UL-CB enclosed within a Hofmann enclosure.

2.08 WIRING

Each fixed camera located within 328 feet (channel length) of the wiring closet shall be provided with one dedicated 4 Pair UTP (Unshielded Twisted Pair), CCTP Category 6, 22 AWG cable; two pairs to be used for power, one pair for video and one pair for control.

Each Pan/Tilt/Zoom and outdoor dome camera located within 328 feet of the wiring closet shall be provided with one dedicated 4 pair 22 AWG UTP, CCTP Category 6, cable, **two pairs to be used for power**, one pair to be used for video and one pair to be used for controls.

For **Outdoor PTZ** cameras, power **for heater/blower** shall be provided over a separate 16 AWG or larger stranded wire-pair **conductors** from a central power supplies. **Circuits shall originate at one panel, where possible, and have circuit**

breakers marked and equipped with protective lock. Indoor PTZ cameras without heater/blower shall be powered via CCTP cable.

Contractor shall provide minimum 3 #12 THHN conductors for all 120 VAC circuits when external power is required.

All wiring (Category 6 cable, control, low voltage and power) shall be installed in metal raceway, except when approved for installation in cable tray or hung ceiling. All power wiring shall be installed according to National Electrical Code.

No wiring shall be exposed, except in the console or cabinet, where the connections to the individual components are made.

Splicing may only be accomplished with approved connectors, and only in approved splice boxes. All splicing points must be clearly defined in the wiring diagram.

On installations exterior to building(s), all splices shall be made in weatherproof NEMA boxes, using gel-type insulation displacement or solder type connectors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall permanently fasten all the equipment as indicated on the drawings in an approved manner, with all necessary hardware.

B. Contractor shall provide all conduits, wiring, outlet boxes, and all accessories necessary to complete the wiring to all components of the system. All connections shall be made complete and tested.

C. Transformer located within a metal enclosure shall be wall mounted inside the building, as close as possible to each camera (usually in hallways). Provide wiring and conduit to connect the secondary (24 VAC) of the transformer to the nearest outdoor camera, at a distance not to exceed 100 feet.

D. The Contractor shall be aware of the fact that some schools are historical landmark buildings. No alterations to building exterior or structure may take place, unless duly approved by the Architect/Engineer of Record.

3.02 GROUNDING

A. All Video Surveillance racks/cabinets shall be grounded according to manufacturer's instructions. Contractor shall provide a #6 stranded copper bonding

conductor from each rack/cabinet to the "Grounding Busbar" in the IDF/MDF room or at main water pipe.

3.03 LABELING OF CABLES, PATCH PANELS AND CAMERAS:

A. Cables are to be tagged at both station and closet ends with an alpha and four-digit number beginning with C1-01 or E1-01 ("C"=Interior Camera, "E"=Exterior Camera "1"=floor, "01"=camera number)and increasing in increment of 1. It shall be a sticky tag, wrapped and secured to the cable behind both the camera jack faceplate and patch panel.

All cable and termination labels are unique identifiers, which shall be permanent and comply with TIA/EIA 606 labeling standards. At the closet end, the patch panel termination is labeled at the corresponding panel port with two points of information concerning the far end and each separated by a dash:

(1) Camera number at the other end of the cable
(2) Cable number (four digits)

At the camera side, the cable is labeled with two points of information pertinent to the cable far end and each separated by a dash:

(1) Room number from the rack or cabinet.
(2) Cable number on the jack faceplate (four digits)

The cable numbers shall be in sequence for each closet. For example, if there are 5 camera cables originating from first floor Video Surveillance Rack-1 (VSR-1), then the cable numbers shall be C1-01 thru C1-05. The second floor closet would start over from C2-06.

In addition, every patch panel within the building shall be identified with a unique 2-digit number permanently stamped or labeled on the front middle top of each patch panel.

3.04 TESTS AND CLOSEOUT DOCUMENTATION

A. TESTS

1. Wiring shall be tested from camera to cable termination at the patch panel prior to acceptance. The test results shall meet requirements Category 6 cable or greater.

2. Cameras shall be performance tested after the school network is operational.

3. Remote site access shall be tested after the network remote access is operational.

4. AI shall be available for the entire system operational test, conducted by the system integrator with participation of the DOE Security Unit. Final sign off will be by Authority representative, in the presence of the DOE Security Unit.

5. Cameras shall be bench tested for video, power, and control prior to installation using a portable field test monitor, 110VAC/24VAC plug-in power transformer, and a RS485 control signal generation unit.

The CCTP cabling installation shall be tested by the installer prior to Acceptance from jack-to-patch panel (Permanent Link Testing) to Category 6 performance standard EIA/TIA 568-B.2-1 using approved field test equipment and methodology as per the above standard. Approved field testing equipment shall be Fluke/ **Microtest Omni Scanner II, Fluke** Model DSP-4000, Agilent Technologies Model WireScope 350, or approved equal. All test results shall be provided in the following formats:

1. Printed (3 bound copies)

2. **CD** (Windows version)

B. CLOSEOUT

Contractor shall submit the following:

1. Written guarantee for three years from date of substantial completion.

2. Instruction on operation and maintenance.

3. **Provide floor plans and single line riser diagram in electronic formats: AUTOCAD or Visio (VSD).**

4. Manufacturer's cut sheets on all equipment and components of the Cabling system. All devices, components, equipment and wiring requirements shall be shown on riser diagrams, individual opening elevations, and point to point wiring diagrams. The submittals shall show proposed locations for all material. Include a manual with specific descriptions for each openings operation written in layman terms. A written description of the theory of operation of the system shall be included. Supply six copies of the entire submittal.

END OF SECTION

SUBMITTAL	DATE SUBMITTED	DATE APPROVED

A. Shop Drawings:

1. The wiring and schematic diagrams of the wiring system as proposed to be installed.
2. Coordinated rack/cabinet plans and elevations of main equipment room and each telecommunications closets identifying the locations, dimensions of all terminating hardware provided by this contractor.
3. Photographs of proposed cameras mounting location (marked on wall or ceiling) and their respective field of view.

B. Product Data:

Catalog sheets, specifications and installation instructions for all products.

C. Sample:

3. CCTP Category 6e Cable.
4. Cable connector

D. Mounting details for typical indoor/outdoor fixed and PTZ cameras.

E. Certificate of compliance with the Quality Assurance and Maintenance requirements.

F. Warranty.

G. Operation and Maintenance Manuals, including a single line riser diagram and floor plans in paper and electronic form of the installed work, including interconnection of all equipment and cabling requirements. Line diagrams and floor plans are to be submitted in electronic formats in AUTOCAD or Visio (VSD) diagram format.

H. Test results and certificate of completion of testing.

I. Qualification of authorized installer of CCTP Category 6 cable.

J. Training.