



Pompano Beach Air Park

General Aviation Security Enhancements

CIP# 13-237

Technical Specifications



ISSUED FOR BID

PREPARED BY:



© 2014 KIMLEY-HORN AND ASSOCIATES, INC.
5200 NW 33rd Avenue, Suite 105, Fort Lauderdale, FL 33309
PHONE (954) 535-5100 FAX (954) 739-2247
WWW.KIMLEY-HORN.COM CA 0000898

IN ASSOCIATION WITH:

HILLERS ELECTRICAL
ENGINEERING, INC.
23257 STATE ROAD 7, SUITE 100
BOCA RATON, FLORIDA 33428
(561) 451-6185
(561) 451-4886 FAX
LICENSE NO: EB 0008877



DOCUMENT 00 01 10

TABLE OF CONTENTS

Section Title

00 01 10 Table of Contents

CONTRACTING REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00 Summary
01 25 00 Substitution Procedures
01 33 00 Submittal Procedures
01 70 00 Execution and Closeout Requirements

DIVISION 16 – ELECTRICAL

16 00 1 Electrical

DIVISION 26 – LOW VOLTAGE

26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 33 Raceway and Boxes for Electrical Systems
26 05 53 Identification for Electrical Systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 23 00 Video Surveillance

PMPSECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Contract Description
- B. Basis of Design (BOD)
- C. Work by Owner
- D. Work by Contractor
- E. Contractor's use of premises
- F. Work Sequence
- G. Owner's Occupancy
- H. Laws, Permits, & Regulations
- I. Hurricane Precautions
- J. Cleaning Up – Owner's Right to Clean up

1.2 CONTRACT DESCRIPTION

- A. The City of Pompano Beach has defined a Statement of Work (SoW) under this Project for the installation of Closed Circuit Television (CCTV) surveillance cameras, a wireless network used to transmit the video streams, lighting, and related security upgrades at the Pompano Beach Air Park (PMP). These upgrades include the following three (3) sub-systems:
 - 1. Video Management Software (VMS) system
 - 2. Wireless Communications Network
 - 3. Lighting Improvements
- B. The proposed VMS system is to provide the functionality specified in Section 28 23 00 – Video Surveillance. The VMS system is to serve as a single point of interface for the CCTV Surveillance System and is to include the following key components:

1. The VMS system is required to integrate the new CCTV surveillance cameras proposed under this project for all locations designated in plans package drawings.
- C. Wireless CCTV Camera Surveillance System Network – A wireless network as specified in the Construction plans package documents is to be built out to support the proposed CCTV camera surveillance system. This wireless network will be comprised of two (2) sets of wireless bridge nodes. All wireless communications will tie back into the telecom room contained in the main administration building.

1.3 BASIS OF DESIGN

- A. PMP/User Group – Pompano Beach Airpark (PMP) will be the primary user of the system installed as part of this contract. The PMP Manager will monitor the video data from the Video Management System workstation provided under this project which is to be located in his office
- B. Intent of CCTV Surveillance System Upgrade – The CCTV system to be furnished hereunder is meant to enhance the current security plan by acting as a force multiplier and reducing response time to detected threats as well as provide additional video coverage. Camera points-of-view must cover target areas and have sufficient clarity for the operator to determine the number of persons, their physical condition and their behavior.
- C. Performance Expectation
1. Video Cameras – The proposed system design intent is a network IP CCTV camera based system utilizing the most efficient video compression that will produce the highest level of video quality for the given application. The system is to be used for general surveillance and producing an archive of quality video for use in understanding occurrences at the entrance/exit gates, parking lot, and airfield.. As such, video cameras selected by the CONTRACTOR shall adhere to the guidelines outline in Section 28 23 00 – Video Surveillance. Camera selection criterion shall take into account site environmental, worst case lighting conditions, required resolution, and the desired view. The CONTRACTOR shall determine camera selection only after a camera survey establishing site conditions is complete.

The CONTRACTOR shall provide video cameras and/or equipment that overcome adverse site conditions. Examples of site conditions adversely affecting quality video are low light, distance to scene, backlighting and obstruction of the

major desired line of sight.

The CONTRACTOR shall provide video cameras that produce quality video (video images with mounting, resolutions and lighting sufficient to accomplish the camera's stated purpose).

The design intent is that video cameras shall stream video to be stored directly onto the VMS workstation using either H.264 or MPEG-4 with 10% compression and at full frame rate within the Terminal and MJPEG at full frame rate for the PIDS. The CONTRACTOR may use lower frame rates and higher compression for those camera placed on a bandwidth limited general data network with the approval of the PMP.

2. Wireless Access Point (WAP) cabinet – This is to serve as the equipment enclosure cabinet for the communications and electrical power required to connect edge devices along the PMP perimeter (e.g. at entrance/exit gates) back to the Video Management Software workstation. It is intended to encase the ruggedized Layer 2 access switch, the fiber optic management assembly, transient voltage surge suppressor (TVSS), uninterruptible power supply (UPS) and power distribution unit (PDU), as well as other ancillary components.
3. Video Management Software – The design intent is to have the Video Management Software serve as a single point of interface for: 1) control of all the CCTV cameras, 2) any VMS alerts and alarms, and 3) the management of video storage.
4. Video Storage Requirements – The proposed system is intended for general surveillance. A likely use of this video system is the searching of archive after an occurrence in order to understand its nature and cause. As such, the video archive should contain the highest quality video practical. In addition, it is the design intention of the proposes system to provide all additional storage required to support the existing camera storage strategy described as follows: MJPEG 4 CIF resolution 30 days, 30 frames/second (on alarm) and 12 frames/second (standard viewing), and one day full frame event video. Roll over shall occur on the 31st day. The design intent for all new IP CCTV cameras is to store the camera video streams in either H.264 or MPEG-4 format with 50% compression and 15 frames per second standard recording and 30 frames per second on alarm. The roll over rate is 30 days. The calculated projected storage requirements assumes 4 CIF resolution for existing CCTVs camera which produces a storage requirement per camera of approximately 9 GB per day. The aggregate storage requirement is on the order of 1.5 TB distributed across the entire PMP facility in accordance with the location camera count. The storage requirements have been calculated using

the Axis cameras web calculator in addition to other online storage tools and CCTV camera manufacturers and only represent estimates. Final design storage requirements depend on design decisions and preferences concerning the actual storage strategy configuration made and implemented by the CONTRACTOR.

5. Expected Video Bandwidth – The design intent is to limit, to the extent possible, camera video signaling between the cameras and the Network Video Management cabinet via the camera LAN.

D. Warranty and Maintenance Requirements

1. Video Management System – The VMS is to carry a minimum of a one (1) year warranty which is to begin at final acceptance after the completion of a successful 90-day burn-in period.
2. System components – Each of the CONTRACTOR furnished equipment system components, including software and firmware, are to carry a minimum one (1) year warranty period or the standard factory warranty, whichever is greater, to be provided by the CONTRACTOR. The warranty shall ensure that the installed system elements conform to its functional requirements and specifications, and shall function properly for the purpose of which it is intended. The warranty shall allow for replacement or repair at the discretion of the CONTRACTOR and shall include any necessary upgrades of CONTRACTOR furnished firmware and/or operating systems.
3. System elements shall be delivered in original packages with labels intact and identification clearly marked.
4. System elements shall not be damaged in any way and shall comply with manufacturer's operating specifications.
5. System elements that are declared non-operational (dead on arrival) by the CONTRACTOR shall be replaced without delay.
6. System elements and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. System elements damaged prior to system acceptance shall be replaced at no cost to PMP.
7. The CONTRACTOR shall provide preventative maintenance services during the one (1) year warranty period. Preventative maintenance shall include as a minimum the following:
 - a. Visit each camera and visually inspect for damage. Clean domes (semi-annually).

- b. Visually check camera video image quality and adjust as necessary (yearly).
 - c. Examine all other system equipment and related components installed by the CONTRACTOR (semi-annually).
 - d. Visually check each camera for proper video (daily check by PMP).
 - e. Autonomous communications check (continuous check by PMP).
8. Cameras reported to the CONTRACTOR by the PMP for corrective maintenance are to be replaced with new camera and new camera shall be configured on site. In support of preventive and corrective maintenance, records on individual and camera site should be maintained.
- a. Each site should have a record. That record should contain the site specific camera configuration.
 - b. The site record should contain the preventative maintenance performed with date and action.
 - c. The site record should contain the installed camera identification history and site specific camera configuration.
 - d. Each camera should have a record. The camera record should contain the corrective maintenance history for the camera.
 - e. Camera record should contain the location history of the camera.
 - f. The camera record should contain approximate run hours. This allows calculating camera Mean Time Between Failure (MTBF).
9. Provide lead technicians to perform installation and maintenance that are manufacturer certified for the required work and that have adequate experience on the supplied system elements.
10. Warranty Response Time – The CONTRACTOR shall respond to PMP request to provide warranty related services during the one (1) year warranty period on an emergency call-back basis twenty four (24) hours a day, seven (7) days a week during the warranty period.
- a. “Response Time” shall mean the time when a vendor dispatch operator receives a phone call from PMP to the time a service technician arrives

on-site at the Airpark.

- b. “Event” means an incident whereby the System is either not working or its operation is inconsistent with Documentation. Events are Priority 1, 2, or 3 as defined below.
11. **PRIORITY 1 EVENT- CRITICAL BUSINESS EVENT** means the impact of the reported Defect is such that the PMP is unable to either use the System or reasonably able to continue working using the System. Examples of a Priority 1 Event include:
- a. Loss of camera views (systemic failure), regardless of the underlying cause (software, hardware, etc.) within a mission critical area as defined by PMP.
 - b. Loss of camera views airside.
 - c. Loss of camera views at the entrance/exit gates
 - d. Loss of cameras views of the parking lot.

The PMP shall contact CONTRACTOR if an Event occurs and CONTRACTOR shall log the Event. The CONTRACTOR shall respond to PMP on all Priority 1 Events within four (4) hours after PMP logs in the Event with the CONTRACTOR, Further, the CONTRACTOR shall use commercially reasonable efforts to resolve all Priority 1 Events within twelve (12) hours after the Event is logged. Such resolution time frame will be suspended during any period in which CONTRACTOR is waiting for additional valid required information from PMP relating to said Priority 1 Event.

12. **PRIORITY 2 EVENT-SIGNIFICANT BUSINESS EVENT** means important features of the System are not working as determined by PMP. While other areas of the System may not be impacted, the reported Defect has created a significant, negative impact on the PMP’s productivity and/or services level. Examples of a Priority 2 Event include:
- a. Loss of camera views (systemic failure) regardless of the underlying cause (software, hardware, etc.) in non-mission critical areas not identified as a Priority 1 Event.

- b. Loss of individual camera views regardless of the underlying cause (software, hardware, etc.) in mission critical areas as defined by PMP.
- c. Loss of coupling between Access Control Events and the recording of those events Loss of coupling will result in storage of video at 12 frames per second in lieu of full frame rate.
- d. Loss of archiving data or access to archived data.

PMP shall contact the CONTRACTOR if an Event occurs and the CONTRACTOR shall log the Event. The CONTRACTOR shall respond to PMP on all Priority 2 Events within four (4) hours after PMP logs the Event with the CONTRACTOR.

The CONTRACTOR shall use commercially reasonable efforts to resolve all Priority 2 Events within twenty-four (24) hours after the Event is logged. Such resolution time frame will be suspended during any period in which the CONTRACTOR is waiting for valid additional required information from PMP relating to said Priority 2 Event.

13. PRIORITY 3 EVENT-SOME BUSINESS IMPACT EVENT means important features of the System are not working as determined by PMP. The reported Defect has a localized impact on the performance and operation of the facility. Examples of a Priority 3 Event include:
- a. Loss of individual camera views regardless of the underlying cause (software, hardware, etc.) in non-mission critical areas.
 - b. Loss of individual CONTRACTOR install monitors regardless of location of installation.
 - c. Any other failures of equipment provided by and supported by the CONTRACTOR not specifically identified above.
14. PMP shall contact the CONTRACTOR if an Event occurs and the CONTRACTOR shall log the Event. The CONTRACTOR shall respond to PMP on all Priority 3 Events within four (4) hours and shall resolve the Event within three (3) calendar days of notification. The CONTRACTOR shall provide status updates on the Event as it is resolved.
- a. Maintain locally, near the Place of the Work, an adequate stock of parts

for replacement or emergency purposes.

- b. Any required software licenses for any CONTRACTOR furnished software shall be identified and supplied by the CONTRACTOR. Licenses shall be “Site Licenses” which shall cover all CONTRACTOR furnished equipment.
- c. All software licenses and warranties shall be registered in the name of PMP.
- d. All upgrades and updates for any CONTRACTOR furnished software shall be provided at no additional charge during the maintenance period.

- 15. If for any reason, the manufacturer discontinues any model or version of a system element provided during this project, the element in question must continue to be maintained throughout the warranty and maintenance periods. Alternatively, at no additional cost to PMP, a full compliant and compatible replacement model or versions may be provided in its stead, subject to approval by PMP.

1.4 WORK BY OWNER

- A. There is no additional work anticipated by PMP as part of this project.

1.5 WORK BY CONTRACTOR

- A. Definition: All references made herein to the “CONTRACTOR” within the documents to the Work consists of Construction/Integration services that includes, but are not limited to, the following:
 - 1. Obtain all required Building Permits.
 - 2. Provide all labor, equipment, materials, general conditions, bonds, insurance and all other associated resources and services as required under this agreement in order to properly execute this contract.
 - 3. Furnish and install fixed and pan-tilt cameras in the quantities and locations necessary to provide coverage based on the details provided in the Construction plans package documents.
 - 4. Provide electrical engineering services, equipment and any other resources needed to provide the electrical services to the CCTV hardware. In addition, provide mechanical engineering services and equipment based on the detail provided in the Construction plans package documents.

1.6 CONTRACTOR'S USE OF PREMISES

- A. The Airpark will continue to function. The CONTRACTOR shall take measures necessary to limit the use of the premises to construction within the required areas for installation of the system components. The CONTRACTOR shall allow of any PMP and tenant occupancy, and use by the public during the Airpark operating times.
- B. In locations within areas utilized by vehicular traffic, the CONTRACTOR shall provide maintenance of traffic plan which utilizes barricades, cones and other devices which protect the traveling public and provide clear direction regarding traffic flow and limits of work areas.
- C. The CONTRACTOR shall schedule and coordinate with the PMP Project Manager and the PMP Airport Operations any shut down or disruption to public services a minimum of seventy- two (72) hours in advance.
- D. The CONTRACTOR shall be responsible for all temporary directional signage, safety and barricading required for passenger services.
 - 1. The CONTRACTOR shall submit a plan indicating signage, safety, and barricading at the pre-construction meeting.
 - 2. Directional signage at the access gate and/or along the delivery route to the storage area or work site shall be directed by Operations.
- E. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
- F. The CONTRACTOR access to site shall be shown on plans or as directed by Operations. The CONTRACTOR shall not permit any unauthorized construction personnel or traffic on the site. The CONTRACTOR shall be responsible for traffic control to and from the various construction areas on the site. The CONTRACTOR is responsible for immediate cleanup of any debris deposited along the access road because of his/her construction traffic.
 - 1. Keep driveways and entrances serving the premises clear and available to PMP, Tenant and their employees at all times, and the public. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
- G. All CONTRACTOR material orders for delivery to the site will use as a delivery address the access point at the CONTRACTOR storage site at the Airport.

1. Delivery of materials and removal of demolished and discarded materials shall be scheduled a minimum of 48 hours prior to delivery.
 2. The CONTRACTOR shall schedule and coordinate all deliveries and removal of debris with the Project Manager.
- H. The limits of construction material storage areas, equipment storage areas, parking areas and other areas as required by the CONTRACTOR shall be as indicated in the documents or as directed by PMP. The CONTRACTOR shall erect and maintain suitable fencing, marking and/or warning devices suitable for both day/night use to delineate the perimeter of all such areas.
1. Use of the Existing Building: Maintain the existing building in a weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
- I. Should Fire Alarm or Sprinkler shutdown be required, they shall be coordinated with PMP a minimum of 48 hours in advance. Coordinate with PMP Maintenance through the PMP Project Manager. Air conditioning shut downs should be coordinated with PMP Maintenance through the PMP Project Manager.
- J. Access to Telecom Room shall be coordinated with the PMP Project Manager. Access to Electrical Room shall be coordinated with the PMP Project Manager.
- K. Roof access shall be coordinated with the PMP Project Manager.
- L. All Hazardous material to be use or issues related to public safety shall be coordinated with the Fire Marshal's office.

1.7 WORK SEQUENCE

- A. Construct Work in stages to accommodate PMP's occupancy requirements during construction period, coordinate construction schedule and operations with PMP.

1.8 OWNER OCCUPANCY

- A. Full OWNER Occupancy: PMP, its tenants and the public will occupy the site and existing building and adjacent facilities (outside the limits of the construction area) during the entire construction period. Cooperate with PMP during construction operations to minimize conflicts, facilitate occupancy usage and protect persons and property in the project area during the entire construction period. Perform the "Work" so as not to

interfere with PMP's operations.

1. Unless otherwise directed by PMP, work in public and operational areas shall be scheduled during normal business hours.
2. Work in the communications rooms and other non-public or non-operational areas can be accomplished during normal business hours.

1.9 LAWS, PERMITS AND REGULATIONS

- A. The CONTRACTOR shall comply with all applicable laws, ordinances, regulations, codes, ADA requirements, etc.
- B. The CONTRACTOR shall obtain and pay for all license and permits, all fees and/or charges for connection to outside services and parking for the CONTRACTOR's vehicles.
- C. The CONTRACTOR and all subcontractors shall abide by FAA and PMP's safety and security regulations and procedures relative to access to, and work in, Airport Operations Areas and secured facilities.
- D. All entities performing work on the site shall comply with the Authority's insurance requirements.

1.10 HURRICANE PRECAUTIONS

- A. During such periods of time as are designated by the United States Weather Bureau as being a hurricane warning or alert, the CONTRACTOR, at no cost to PMP, shall take all precautions necessary to secure the Project site in response to all threatened storm events, regardless of whether PMP or the CONTRACT ADMINISTRATOR OR the DESIGNEE has been given notice of same.
- B. Compliance with any specific hurricane warning or alert precautions will not constitute additional work.
- C. Suspension of the Work caused by a threatened or actual storm even regardless of whether PMP has directed such suspension, will entitle the CONTRACTOR to additional Contract Time as non-compensable, excusable delay, and shall not give rise to a claim for compensable delay.

1.11 CLEANING UP – OWNER'S RIGHT TO CLEAN UP

- A. The CONTRACTOR shall at all times keep the premises free from accumulation of

waste materials or rubbish caused by its operations. At the completion of the Project, the CONTRACTOR shall remove all its waste materials and rubbish from and about the Project as well as its tools, construction equipment, machinery and surplus materials. If the CONTRACTOR fails to clean up during the prosecution of the Work or the completion of the Work, PMP may do so and the cost thereof shall be charged to the CONTRACTOR. If a dispute arises between the CONTRACTOR and separate contractors as to their responsibility for cleaning up, PMP may clean up and charge the cost thereof to the contractors responsible therefore as the CONSULTANT shall determine to be just.

PART 2 - PRODUCTS: NOT USED

PART 3 - EXECUTION: NOT USED

END OF SECTION 01 10 00

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes procedure for substituting video management software, Ethernet switches, wireless access point nodes, video management system workstation, video monitors, transient voltage surge suppressors, uninterruptible power supply (UPS) unit, cable management units, patch panels, CAT 5e cabling, electrical wiring, network equipment cabinet, network equipment enclosures, CCTV cameras.

1.2 ELIGIBILITY OF PRODUCT SUBSTITUTION

A. Substitution Procedure

1. The Contractor must supply a formal written request to the City of Pompano Beach Airpark (PMP) stating the product being requested for substitution along with catalog cut-sheet(s) for the proposed substitute product. The proposed substitute product cut-sheet(s) are to include at a minimum the following information:
 - Manufacturer
 - Trade name
 - Model number
 - Electrical specifications
 - Mechanical specifications
 - Physical dimensions
 - Weights

PMP shall have ten (10) business days to review the submitted request to determine if the substitute product meets Minimum Technical Requirements detailed in the specification. The Contractor shall not procure any piece of substitute hardware, software, or peripherals without prior written approval from PMP.

Substitutions will not be granted until after project award.

The Contractor shall base his bid on the product and/or performance specification detailed herein.

END OF SECTION 01 25 00

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Submittal procedures.
 - 2. Construction progress schedules.
 - 3. Proposed products list.
 - 4. Product data.
 - 5. Shop drawings.
 - 6. Samples.
 - 7. Design data.
 - 8. Test reports.
 - 9. Certificates.
 - 10. Manufacturer's instructions.
 - 11. Manufacturer's field reports.
 - 12. Erection drawings.

1.2 SUBMITTAL PROCEDURE

- A. Transmit each submittal in a three (3) ring binder along with a product index listing the model number and description of the product with Architect/Engineer accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite Project, and deliver to Design Criteria Consultant at

business address. Coordinate submission of related items.

- F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Design Criteria Consultant review stamps.
- I. When revised for resubmission, identify changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- K. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.
- L. The Contractor shall not perform any portion of the Work requiring submittal and review of Record Drawings, Shop Drawings, product data, or samples until the Pompano Beach Airpark or its designated assignee have approved the respective submittal. All work shall be in accordance with approved submittals.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedules within 15 days after date of Owner-Contractor Agreement established in Notice to Proceed. After review, resubmit required revised data within ten days.
- B. Submit revised Progress Schedules with every Application for Payment.
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.
- D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

- E. Submit computer generated horizontal bar chart with separate line for each section of Work, identifying first work day of each week.
- F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.
- G. Indicate estimated percentage of completion for each item of Work at each submission.
- H. Submit separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products and products identified under Allowances, and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.
- I. Indicate delivery dates for Owner furnished products and products identified under Allowances.
- J. Revisions to Schedules:
 - 1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 - 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
 - 3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate contractors.

1.4 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Owner-Contractor Agreement Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

- A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.6 SHOP DRAWINGS

- A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- D. Submit in form of one reproducible transparency.

- E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.7 SAMPLES

- A. Samples: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples for Selection as Specified in Product Sections:
 - 1. Submit to Architect/Engineer for aesthetic, color, or finish selection.
 - 2. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for Architect/Engineer selection.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Design Criteria Consultant will retain one sample.
- F. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.
- H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00 - Execution and Closeout Requirements.

1.8 DESIGN DATA

- A. Submit for Design Criteria Consultant's knowledge or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

- A. Submit for Design Criteria Consultant's knowledge or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Design Criteria Consultant, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Design Criteria Consultant.

1.11 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Design Criteria Consultant for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Design Criteria Consultant's benefit or for Owner.
- B. Submit report in duplicate within 24 hours of observation to Architect/Engineer for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

- A. Submit drawings for Design Criteria Consultant's benefit as contract administrator or for the Owner.

- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by Design Criteria Consultant or Owner.

END OF SECTION 01 33 00

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Starting of systems.
 - 4. Demonstration and instructions.
 - 5. Testing, adjusting and balancing. Protecting installed construction.
 - 6. Project record documents.
 - 7. Operation and maintenance data.
 - 8. Manual for materials and finishes.
 - 9. Manual for equipment and systems.
 - 10. Spare parts and maintenance products.
 - 11. Product warranties and product bonds. Maintenance service.

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
- B. Provide submittals to Owner required by authorities having jurisdiction.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Owner will occupy all of building as specified in Section 01 10 00 - Summary.

1.3 FINAL CLEANING

- A. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- B. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- C. Replace filters of operating equipment.
- D. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner seven days prior to start-up of each item.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- D. Verify wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractors' personnel in accordance with manufacturers' instructions.
- F. Submit a written report in accordance with Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products as detailed in specification Section 28 23 00 Video Surveillance.

1.6 TESTING, ADJUSTING AND BALANCING

- A. Design Build Team will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing as necessary.

1.7 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.8 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Materials utilized. Record description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 2. Field changes of dimension and detail.
 3. Details not on original Contract drawings.
- G. Submit five (5) copies of all documents to Architect/Engineer with claim for final Application for Payment.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit five (5) copies of data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component. Operating instructions.
 - d. Maintenance instructions for equipment and systems.

- e. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
- 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Originals of warranties and bonds.

1.10 MANUAL FOR MATERIALS AND FINISHES

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Design Criteria Consultant will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Design Criteria Consultant comments. Revise content of document sets as required prior to final submission.
- D. Submit five sets of revised final volumes in final form within 10 days after final inspection.
- E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.
- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- H. Additional Requirements: As specified in individual product specification sections.

- I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.11 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Design Criteria Consultant will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Design Criteria Consultant comments. Revise content of document sets as required prior to final submission.
- D. Submit five sets of revised final volumes in final form within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.
- G. Include color coded wiring diagrams as installed.
- H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- J. Include servicing and lubrication schedule, and list of lubricants required.
- K. Include manufacturer's printed operation and maintenance instructions.

- L. Include sequence of operation by controls manufacturer.
- M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- N. Include control diagrams by controls manufacturer as installed.
- O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- R. Include test and balancing reports as specified in Section 01 40 00 – Quality Requirements.
- S. Additional Requirements: As specified in individual product specification sections.
- T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.12 SPARE PARTS AND MAINTENANCE REQUIREMENTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.13 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.

- E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.14 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification section 01 10 00 paragraph 1.3 G for three years from date of Final Acceptance.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, and adjustment of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.
- E. DBT shall provide a written maintenance program for owner review and approval. This plan shall cover all items furnished and installed by the DBT including mechanical and electrical systems, CCTV hardware, video wall and all video storage equipment. The plan shall include a preventative maintenance element.

PART 2 - PRODUCTS: NOT USED

PART 3 - EXECUTION: NOT USED

END OF SECTION 01 70 00

SECTION 16001
ELECTRICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section covers the work necessary for the construction of the electrical system shown on the accompanying Drawings. The work included under this section includes providing all materials, furnishing all labor and except as provided under other sections of these Specifications, by others or by the owner, to install a complete functioning electrical system. This installation shall include all incidental items whether shown on the drawing, call for in these Specifications or not. It is not the intent for the Drawings or these Specifications to show or specify each and every required device, conduit, conductor, control device or other incidental items.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
1. C80.1, Rigid Steel Conduit-Zinc Coated.
 2. C80.3, Electrical Metallic Tubing-Zinc Coated.
 3. Z55.1, Gray Finishes for Industrial Apparatus and Equipment.
- B. Federal Specifications (FS):
1. W-C-596, Connector, Receptacle, Electrical.
 2. W-S-896E, Switches, Toggle, Flush Mounted.
- C. National Electrical Contractor's Association, Inc. (NECA): 5055, Standard of Installation.
- D. National Electrical Manufacturers Association (NEMA):
1. AB1, Molded Case Circuit Breakers and Molded Case Switches.
 2. ICS2, Standard for Industrial Control Devices, Controllers, and Assemblies.
 3. PB1, Panelboards.
 4. TC2, Electrical Plastic Tubing (EB) and Conduit (EPC-40 and EPC-80).
 5. TC3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 6. WD1, General Requirements for Wiring Devices.
 7. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
- E. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- F. Underwriters Laboratories, Inc. (UL):
1. 1, Standard for Safety Flexible Metal Conduit.
 2. 651, Standard for Safety Schedule 40 and 80 PVC Conduit.
- G. Lightning Protection Institute (LPI): 175, Installation Standard.

1.3 CODES AND PERMITS

- A. All work shall be performed in strict accordance with the current addition of Association, IEEE Standards, NECA Standards and shall comply with the Authority having jurisdiction over the project. Conflicts will be resolved at the discretion of the Engineer.
- B. Wherever the Specifications or Drawings exceed those of the applicable codes or authorities the requirements contained herein shall govern. Code compliance is mandatory. Nothing contained in these Contract Documents shall be construed as permitting work to be performed outside the requirements of the applicable codes or governing authorities.
- C. Obtain all required permits and pay all fees required by any agency having jurisdiction over this project. Upon completion of the work obtain from regulatory authorities signed permits indicating the work is acceptable to the authority having jurisdiction.

1.4 COMPLIANCE

- A. All the work executed under this section shall meet the General and Special Conditions sections of this Specification as if fully stated herein.

1.5 SUBMITTALS

- A. Furnish submittal and shop drawing information on all major electrical material and equipment.

1.6 INTENT OF DRAWINGS

- A. The electrical drawings show only general locations of equipment devices, and raceways, unless specifically dimensioned. The CONTRACTOR shall be responsible for the proper routing of raceways, final sizing of conductors, and location of equipment and connections. The control diagrams for the equipment are diagrammatic and intended to show the desired operation. The CONTRACTOR shall install the controls exactly as -- shown unless this operation will cause failure of the equipment due to unique operating characteristics of the supplied equipment not known to the ENGINEER. The CONTRACTOR shall notify the ENGINEER of such conflicts within 30 days of the Contract award and receive written resolution before proceeding with the Contract work. Any damages to CONTRACTOR-supplied equipment arising due to improper control shall be the responsibility of the CONTRACTOR.

1.7 PREBID SITE VISIT

- A. The CONTRACTOR shall familiarize themselves with the site prior to bidding and verify that the specified new equipment and existing equipment modifications can be implemented within their proposed Bid price.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Use of new quality materials is required on this project.
- B. Only materials suitable for the space provided shall be used.
- C. Provide materials and equipment listed by Underwriter Laboratories (UL) wherever standards have been established by that agency.
- D. Where two or more units of the same class of material or equipment are required, provide products of a single -ufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.2 STANDARD PRODUCTS

- A. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications.

2.3 EQUIPMENT FINISH

- A. Provide materials and equipment with manufacturer's standard finish system. Provide manufacturer's standard finish color, except where specific color or materials are indicated. If manufacturer has no standard color, finish equipment in accordance with ANSI No. 61, light gray color.

2.4 RACEWAYS

- A. **PVC Conduit:** use rigid PVC conduit, Schedule 40, UL listed for underground direct burial and UL listed and marked for use with conductors having 90 degrees C insulation. Use conduits, couplings, elbows, nipples, and other fittings meeting the requirements of NEMA TC 2 and TC 3, Federal Specification W-C-1094, UL, NEC, and ASTM specified tests for the intended use.
- B. **Flexible Metal Conduit:** Use UL listed liquid-tight flexible metal conduit consisting of galvanized steel flexible conduit covered with an extruded PVC jacket and terminated with nylon bushings or bushings with steel or malleable iron body and insulated throat and sealing O-ring.
- C. **Rigid Steel conduit:** Use rigid steel conduit, including threaded type couplings, elbows, nipples, and other fittings, galvanized by hot-dipping, electroplating, sherardizing, or metalizing process and meeting the requirements of ANSI C80, NEMA FB 1, UL, and the NEC.
- D. **EMT conduit:** Use electro metallic tubing conduit, including compression type couplings, elbows, nipples, and other fittings, galvanized by hot-dipping, electroplating, sherardizing, or metalizing process and meeting the requirements of ANSI C80, NEMA

FB 1, UL, and the NEC.

2.5 RACEWAY FITTINGS

- A. Fittings for Rigid Steel conduit:
1. Fittings for Rigid Steel conduit shall be of the same manufacturer as the conduit.
 2. Use insulated throat bushings of metal with integral plastic bushings rated for 105 degrees C. For insulated throat bushings for rigid steel conduit, use Thomas and Betts Nylon Insulated Metallic Bushings, or O.Z. Gedney Type B.
 3. Use Myers Scru-Tite hubs for rigid steel conduit.
 4. Use conduit bodies for rigid steel conduit of metal and sized as required by the NEC (NFPA 70-1984). Use Appleton Form 35 threaded Unilets; Crouse-Hinds Mark 9 or Form 7 threaded condulets; Killark Series O Electrolets; or equal, for normal conduit bodies for rigid steel conduit. Where conduit bodies for rigid steel conduit are required to be approved for hazardous (classified) locations, use conduit bodies manufactured by Appleton, Crouse-Hinds, or Killark.
 5. Use only threaded couplings for rigid steel conduit supplied by the conduit manufacturer. Screw and compression fittings not permitted
 6. Use Appleton Type EYF, EYM, or ESU; Crouse-Hinds Type EYS or EZS; or Killark Type EY or EYS, sealing fittings for rigid steel conduit. Where condensate may collect on top of a seal, provide a drain by using Appleton Type SF or Crouse-Hinds Type EYD or EZD Drain Seal.
 7. Use Appleton Type ECDB or Crouse-Hinds ECD drain fittings for rigid steel conduit.
 8. Fittings for Liquid-Tight Flexible Metal Conduit: use insulated throat connectors for liquid-tight flexible metal conduit of metal with an integral plastic bushing rated for 105 degrees C, and of the long design type extending outside of the box or other device at least 2 inches. Use Thomas and Betts Super-Tite Nylon Insulated Connectors, or equal.
 9. Use cable sealing fittings forming a watertight nonslip connection to pass cords and cables into conduit. Size cable sealing fitting for the conductor OD. For conductors with OD's of 1/2 inch or less, provide a neoprene bushing where the conductor enters the connector. Use Crouse-Hinds CGBS, Appleton CG Series, or equal, cable sealing fittings.

2.6 CONDUCTORS 600 VOLTS AND BELOW

- A. All conductors shall be annealed copper. Wire shall be stranded.
- B. Insulation shall be Type XHHW.
- C. Sizes: No wire smaller than size No. 12 AWG shall be installed for lighting, receptacles, or other circuits unless otherwise noted.
- D. Wire Color Identification: Neutral wire white, live wire black, red, blue on 120/208-volt system; Neutral wire white, live wire black, red on 120/240-volt single phase systems; Neutral wire grey, live wire brown, purple, yellow on 277/480-volt system.

Ground wire green.

- E. Identification Devices: Sleeve: Permanent, PVC, yellow or white, with legible machine-printed black markings.

2.7 NAMEPLATES

- A. Provide laminated nameplates with inscription as shown. Nameplates shall be engraved laminated plastic with white lettering on a black background. Attach nameplate with stainless steel panhead screws.

2.8 OUTLET AND DEVICE BOXES

- A. Sheet Steel: One-piece drawn type, zinc- or cadmium-plated.
- B. Cast Metal:
1. Box: Cast ferrous metal.
 2. Cover: Gasketed, weatherproof, cast ferrous metal, with stainless steel screws.
 - a. All junction box covers shall be color coded:
 - 1) Communications shall be blue
 - 2) Power (120V/208V) shall be green
 - 3) Power (277V/480V) shall be yellow
 - 4) Fire Alarm shall be red
 - b. Panel and circuit numbers shall be permanently identified on junction box cover.
 3. Hubs: Threaded.
 4. Lugs (Cast Mounting) Manufacturer:
 - a. Crouse-Hinds; Type FS or FD.
 - b. Appleton; Type FS or FD.

2.9 LIGHTNING PROTECTION

- A. Shop Drawings:
1. Down conductor.
 2. Connecting conductor.
 3. Bond strap.
 4. Air terminals.
 5. Fittings.
 6. Connectors.
- B. Quality Control Submittals: Field test report.
- C. Manufacturers
1. Thompson Lightning.
 2. IPC Protection.
 3. AC Lightning Security.
 4. Lightning & Grounding Systems, Inc.
- D. General

1. System Material: Copper or high copper content, heavy-duty bronze castings, unless otherwise specified.
 2. All material shall comply in weight, size, and composition for the class of structure to be protected as established by UL 96 and 96A.
- E. Air Terminal
1. Material: Solid copper rods, with tapered points.
 2. Length: Sufficient to extend minimum 18 inches above object being protected.
 3. UL 96 Label B applied to each terminal.
- F. Conductors
1. Copper Cable: Bare medium stranded, having 97.5 percent minimum conductivity.
 2. Main Down Conductor: Per UL and NFPA criteria and based on wall height.
 3. Connecting Conductor: Secondary size per UL and NFPA criteria
 4. Bonding Conductor: Flexible strap, minimum 3/4-inch wide by 1/8-inch thick.
 5. All main down and connecting conductors shall bear the UL 96 Label A, applied every 10 feet.
- G. Cable Fastener and Accessories
1. Capable of withstanding minimum pull of 100 pounds.
- H. Fittings
1. Heavy-duty Class II bolt pressure type.
 2. Bolts, Screws, and Related Hardware: Stainless steel.
- I. Cable Connections and Splicers
1. As specified in 16001, GROUNDING.
- J. CONDUIT
1. Schedule 40 PVC, as specified in Section 16001, RACEWAYS.
- 2.10 MAGNETIC LIGHTING CONTACTOR
- A. NEMA ICS 2, UL 508.
- B. Electrically operated by dual-acting, single coil mechanism.
- C. Inherently interlocked and electrically held in both OPEN and CLOSED position.
- D. Main Contacts:
1. Power driven in both directions.
 2. Double-break, continuous-duty, rated 30 amperes, 600 volts, withstand rating of 22,000 amps rms symmetrical at 250 volts.
 3. Marked for electric discharge lamps, tungsten, and general-purpose loads.
 4. Position not dependent on gravity, hooks, latches, or semi-permanent magnets.
 5. Capable of operating in any position.
 6. Visual indication for each contact.

- E. Auxiliary contact relay for three-wire control.
- F. One normally open and one normally closed auxiliary contacts rated 10 amperes at 480-volt.
- G. Fully rated neutral plate.
- H. Provision for remote pilot lamp with use of auxiliary contacts.
- I. Clamp type, self-rising terminal plates for solderless connections.
- J. Enclosure: NEMA 1
- K. Manufacturers:
 - 1. Cutler Hammer.
 - 2. General Electric.
 - 3. Square D.

2.11 WIRING DEVICES

- A. Receptacle, Single and Duplex:
 - 1. NEMA WD 1 and FS W-C-596.
 - 2. Specification grade, two-pole, three-wire grounding type with screw type wire terminals suitable for No. 10 AWG.
 - 3. High strength, thermoplastic base color.
 - 4. Color:
 - a. Office Areas: Ivory.
 - b. Other Areas: Brown.
 - c. UPS: Orange
 - 5. Contact Arrangement: Contact to be made on two sides of each inserted blade without detent.
 - 6. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.
 - 7. Manufacturers:
 - a. Bryant.
 - b. Leviton.
 - c. Hubbell.
 - d. Pass and Seymour.
 - e. Sierra.
 - f. Arrow Hart.

2.12 Panel Boards/Load Centers

- A. NEMA PB I, NFPA 70, and UL 67, including panelboards installed in motor control equipment.
- B. Panelboards and Circuit Breakers: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

- C. Short-Circuit Current Equipment Rating: Fully rated; series connected unacceptable.
- D. Rating: If not otherwise shown in plans. Applicable to a system with available short-circuit current of 42,000 amperes rms symmetrical at 208Y/120 or 120/240 volts and 65,000 amperes rms symmetrical at 480Y/277 volts.
- E. Where ground fault interrupter circuit breakers are indicated or required by code: 5 mA trip, 10,000 amps interrupting capacity circuit breakers.
- F. Cabinet: As shown on plans.
- G. Bus Bar:
 - 1. Material: Copper, full sized throughout length.
 - 2. Provide for mounting of future circuit breakers along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.
 - 3. Neutral: Insulated, rated 150 percent of phase bus bars with at least one terminal screw for each branch circuit.
 - 4. Ground: Copper, installed on panelboard frame, bonded to box with at least one terminal screw for each circuit.
 - 5. Lugs and Connection Points:
 - a. Suitable for either copper or aluminum conductors.
 - b. Solderless main lugs for main, neutral, and ground bus bars.
 - c. Subfeed or through-feed lugs as shown.
 - 6. Bolt together and rigidly support bus bars and connection straps on molded insulators.
- H. Circuit Breakers:
 - 1. NEMA AB 1 and UL 489.
 - 2. Thermal-magnetic, quick-make, quick-break, molded case, of the indicating type showing ON/OFF and TRIPPED positions of operating handle.
 - 3. Non-interchangeable, in accordance with NFPA 70.
 - 4. Locking: Provisions for handle padlocking, unless otherwise shown.
 - 5. Type: Bolt-on circuit breakers in all panelboards.
 - 6. Multipole circuit breakers designed to automatically open all poles when an overload occurs on one pole.
 - 7. Do not substitute single-pole circuit breakers with handle ties for multipole breakers.
 - 8. Do not use tandem or dual circuit breakers in normal single-pole spaces.
 - 9. Ground Fault Interrupter:
 - a. Equip with conventional thermal-magnetic trip and ground fault sensor rated to trip in 0.025 second for a 5-milliampere ground fault (UL 943, Class A sensitivity).
 - b. Sensor with same rating as circuit breaker and a push-to-test button.

- I. Refer to Electrical drawings for additional requirements such as shunt trip on main circuit breaker.
- J. Manufacturers:
 - 1. Eaton Cutler Hammer
 - 2. Or approved equal.

2.13 SUPPORT AND FRAMING CHANNELS

- A. Material:
 - 1. Dry indoors - ASTM A167, Type 316 stainless steel or fiber-reinforced epoxy, as required.
 - 2. All Other Areas: ASTM A167, Type 316 stainless steel or fiber-reinforced epoxy, as required.
- B. Finish:
 - 1. Dry indoors - ASTM A167, Type 316 stainless steel or fiber-reinforced epoxy, as required.
 - 2. All Other Areas: ASTM A167, Type 316 stainless steel or fiber-reinforced epoxy, as required.
- C. Inserts: Continuous.
- D. Beam Clamps: Gray cast iron.
- E. Manufacturers:
 - 1. B-Line.
 - 2. Unistrut.

2.14 NAMEPLATES

- A. Material: Laminated plastic.
- B. Attachment Screws: Stainless steel.
- C. Color: White, engraved to a black core.
- D. Engraving:
 - 1. Pushbuttons/Selector Switches: Name of drive controlled on one, two, or three lines, as required.
 - 2. Panelboards: Panelboard designation, service voltage, and phases.
- E. Letter Height:
 - 1. Pushbuttons/Selector Switches: 1/8 inch.
 - 2. Panelboards: 1/4 inch.

2.12 PANELBOARD / LOADCENTER SURGE PROTECTIVE DEVICE

- A. This section describes the material and installation requirements for surge protective devices (SPD) in switchboards, panel boards, and motor control centers for the protection of all AC electrical circuits.
- B. SPDs shall be listed and component recognized in accordance with UL 1449 and UL 1283.
- C. SPD shall be installed and warranted by and shipped from the electrical distribution equipment manufacturer's factory.
- D. SPD shall provide surge current diversion paths for all modes of protection; L-L, L-N, L-G, N-G in WYE systems, and L-L, L-G in DELTA systems.
- E. SPD shall be modular in design. Each module shall be fused with a surge rated fuse.
- F. A UL approved disconnect switch shall be provided as a means of disconnect in the switchboard device only.
- G. SPD shall meet or exceed the following criteria:
1. Maximum surge current capability (single pulse rated) shall be:
 - a. Branch panelboards 150kA
 2. UL 1449 Listed and Recognized Component Suppression Voltage Ratings shall not exceed the following:

<u>Voltage</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120	400V	400V	400V
480Y/277	800V	800V	800V
- H. SPD shall have a minimum EMI/RFI filtering of -52dB at 100kHz with an insertion ration of 50:1 using MIL STD. 220A methodology.
- I. SPD shall be provided with 1 set of NO/NC dry contacts.
- J. SPD shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period. Warranty will be the responsibility of the electrical distribution equipment manufacturer.
- K. Approve manufactures are:
1. Cutler Hammer CPS Series
 2. Square D Company XTE Series
 3. Current Technology Select 2 series

PART 3 – EXECUTION

3.1 GENERAL

- A. Technique is the essence of the work in this project.
- B. Install materials and equipment in a professional manner utilizing proficient skilled in the particular trade. Provide work which has a neat and finished appearance.
- C. Coordinate electrical work with Engineer and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation.
- D. Check the approximate locations of light fixtures, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, consult the Engineer. The Engineer's decision shall govern. Make modifications and changes required.

3.2 PROTECTION DURING CONSTRUCTION

- A. Throughout this Contract, Provide protection for materials and equipment against loss or damage in accordance with provisions elsewhere in these Contract Documents. Protect everything from the effects of weather. Prior to installation, store items in clean, dry, indoor locations. Store in clean, dry, indoor, heated location items subject to corrosion under damp conditions, and items containing electrical insulation, such as transformers, conductors, motors, and controls.
- B. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.

3.3 MATERIAL AND EQUIPMENT INSTALLATION

- A. Follow manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturer's instructions, codes and regulations, and these Contract Documents, follow Engineer's decision. Keep copy of manufacturer's installation instructions on the jobsite available for review at all times.

3.4 CUTTING AND PATCHING

- A. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition. Use skilled craftsmen of the trades involved.

3.5 LOAD BALANCE

- A. The Drawings and Specifications indicate circuiting to electrical loads and distribution equipment; however, after installation, if necessary, balance electrical load between

phases as nearly as possible on loadcenters, panelboards, etc.

3.6 CLEANING AND TOUCH-UP PAINTING

- A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

3.7 CONDUIT

- A. Schedule 40 PVC shall be used for all underground. All non-aircondition spaces above grade shall be hot dipped rigid galvanized steel. All aircondition spaces above grade shall be EMT.
- B. Conduit shall be sized in accordance with the NEC and shall be of such size and so installed that conductors may be drawn in without injury or excessive strain.
- C. Provide all necessary sleeves and chases required where conduits pass through floors or walls seal all openings and finish to match adjacent surfaces. Where exposed, conduits pass through walls, floors or ceilings, provide fill of same materials as the penetrated surface.
- D. Galvanized Rigid Conduits entering cabinets, pull boxes or outlet boxes shall be secured with double galvanized locknuts, one on inside and outside of box, and bushings.
- E. Conduit shall be sized in accordance with the NEC and shall be of such size and so installed that conductors may be drawn in without injury or excessive strain.
- F. Make final connection to motors where flexible connection is required to minimize vibration or where required to facilitate removal or adjustment of equipment, with 18-inch minimum, 60-inch maximum length of liquid-tight, PVC jacketed, flexible steel conduit where the required conduit size is 4 inches or less. For larger sizes, use nonflexible conduit as specified.
- G. Flash and counterflash all conduits penetrating membrane. All roof penetration shall be sealed unless directed otherwise by the Engineer.
- H. Exposed Raceways: Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes.
- I. Changes in Direction of runs: Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. Field made bends and offsets shall be made with an approved hickey or conduit bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of dirt, or trash in raceways, boxes fittings, and equipment during the course of construction. Clogged raceways shall be entirely freed of obstructions or shall be replaced.

3.8 OUTLET AND JUNCTION BOXES

- A. Provide a box suitable for the conditions encountered at each outlet in the wiring or raceway system and sized in accordance with the NEC.
- B. Install boxes in a secure, substantial manner, supported independently of conduit attachment to the structure. Use stainless steel hardware in all areas.
- C. Install boxes for conduits below grade flush with finished grade.
- D. All boxes shall be rated for use in the environment for which they are installed.

3.9 GROUNDING

- A. All equipment and enclosures, and the complete conduit system shall be grounded securely in accordance with pertinent sections of Article 250 of NEC. All electrically operated equipment shall be bonded to the grounding conduit system via bonding jumpers, grounding busses, and grounding bushings. Grounding shall include the grounding conductors shown on Drawings and additional grounding as required above. All enclosures shall contain a grounding buss tied to the conduit system and enclosure utilizing bonding jumpers #6 minimum.

3.10 CONDUCTORS

- A. No conductor shall be drawn into conduit until conduit system is complete. Lubricant shall be approved by wire manufacturer.
- B. Circuit Identification: Identify power, control conductor circuits, and CAT6 cabling at each termination and in accessible locations such as panels, junction boxes, and terminal boxes.

3.11 COLOR MARKINGS

- A. Where two or more conduits run to a single outlet box, each circuit shall be color coded as a guide in making connections. Colors shall be carried continuously throughout the system if more than one multiwire branch circuit is carried through a single raceway. All circuit conductors of the same color shall be connected to the same underground feeder conductor throughout the installation.

3.12 CIRCUITS

- A. Deviations from conduit runs will be permitted with the Engineer's approval. Combining circuits in single conduit is permitted with proper identification and wire size increase required by NEC.

3.13 CONNECTIONS TO EQUIPMENT

- A. Provide all conduits, wiring, and connections for equipment furnished by the OWNER

or under other sections, including line and low voltage wiring for all equipment. Obtain required information from the other trades and rough-in to meet requirements of said equipment. No allowance will be made for failure to comply with obtaining complete information from other trades.

3.14 LIGHTING FIXTURES

- A. Furnish and install all lighting fixtures, complete with LED lamps and accessories, as indicated. Substitutions will be permitted only with prior written approval of the Engineer. Lighting fixtures shall have a minimum 5 year warranty for complete assembly(including driver), 1 year warranty against defects in design.

3.15 TOUCH UP

- A. After the equipment is installed, touch up any scratches, marks, etc., incurred during shipment or installation of equipment.

3.16 WIRING DEVICES

- A. Receptacles:
 - 1. Install with grounding slot down except where horizontal mounting is shown, in which case install with neutral slot up.
 - 2. Ground receptacles to boxes with grounding wire only.
 - 3. Weatherproof Receptacles:
 - a. Install in cast metal box.
 - b. Install such that hinge for protective cover is above receptacle opening.
 - 4. Ground Fault Interrupter: Install feed-through model at locations where ground fault protection is specified for "downstream" conventional receptacles.
 - 5. Special-Purpose Receptacles: Install in accordance with manufacturer's instructions.

3.17 DEVICE PLATES

- A. Securely fasten to wiring device; ensure a tight fit to the box.
- B. Flush Mounted: Install with all four edges in continuous contact with finished wall surfaces without use of mats or similar materials. Plaster fillings will not be acceptable.
- C. Surface Mounted: Plate shall not extend beyond sides of box unless plates have no sharp corners or edges.
- D. Install with alignment tolerance to box of 1/16 inch.
- E. Engrave with designated titles.
- F. Types (Unless Otherwise Shown):
 - a. Office: Stainless Steel.

- b. Exterior: Weatherproof.
- c. Interior:
 - 1) Flush Mounted Boxes: Stainless Steel.
 - 2) Surface Mounted, Cast Metal Boxes: Cast metal.
 - 3) Surface Mounted, Sheet Steel Boxes: Stainless Steel.
 - 4) Surface Mounted, Nonmetallic Boxes: Plastic.

3.18 LIGHTING AND POWER DISTRIBUTION PANELBOARD

- A. Install securely, plumb, in-line and square with walls.
- B. Install top of cabinet 6 feet above floor unless otherwise shown.
- C. Provide typewritten circuit directory for each panelboard.

3.19 SUPPORT AND FRAMING CHANNEL

- A. Furnish zinc-rich primer; paint cut ends prior to installation, where applicable.
- B. Install where required for mounting and supporting electrical equipment and raceway systems.

3.20 TESTS

- A. General: Carry out tests specified hereinafter and as indicated under individual items of materials and equipment specified in other sections.
- B. Operations: After the electrical system installation is completed and at such time as the Engineer may indicate, conduct an operating test for approval. Demonstrate that the equipment operates in accordance with the requirements of these Specifications and Drawings. Perform the test in the presence of the Engineer or authorized representative. Furnish all instruments and personnel required for the tests. The OWNER will furnish the necessary electric power.
- C. Voltage:
 - 1. When the installation is essentially complete check the voltage at the point of termination of the power company supply system to the project. Check voltage amplitude and balance between phases for loaded and unloaded conditions.

PART 4

4.01 METHOD OF MASUREMENT FOR LUMP SUM (LS), EACH (EA) AND LINEAR FOOT (LF) ITEMS

- A. The quantity of items (identified as LS/EA/LF) to be paid for shall be the number of each type installed as completed units in place, ready for operation, and accepted by the Engineer.

16001-1 One 1" schedule 40 PVC conduit direct buried in earth, complete in place. Includes conduits, connectors, warning tape, excavation, labor,

- backfill, pull string, conduit spacers, sod restoration, dewatering and etc., complete in place. –Price per linear foot
- 16001-2 One 1" HDPE Schedule 40 PVC conduit directional bored 48" deep beneath existing pavement, complete in place. Includes excavation pits, conduits, labor, sod restoration, backfill, pull string, dewatering and etc., complete in place. – Price per linear foot
- 16001-3 #10, XHHW conductor installed in new/existing conduit system. Includes all labor, conductors, testing, cleaning and dewatering, pull string, pulling compound, identification, splice kits, and etc., complete in place. -- Price per linear foot.
- 16001-4 #8, XHHW conductor installed in new/existing conduit system. Includes all labor, conductors, testing, cleaning and dewatering, pull string, pulling compound, identification, splice kits, and etc., complete in place. -- Price per linear foot.
- 16001-5 New single luminaire, concrete pole and pull box installed in earth, complete in place. Includes fixture, pole, identification, grounding, ground rods, internal pole wire, fuse kits, fuses, hardware, pull box, splice kits, bird spikes, lightning protection, conduit, conductors, testing, backfill, grading, sod restoration, windloading calculations, coordination, testing, labor and etc., complete in place. - Price per each
- 16001-6 New quazite pull box with Tier 15 cover installed in earth/rock. Includes pull box, cover, excavation, rock, backfill, coordination, identification, labor, dewatering, grounding, ground rods, hardware, sod restoration, and etc., complete in place. – Price per each
- 16001-7 Hand excavate and intercept existing conduit and conductor system and extend to new composite pull box, complete. Includes excavation, conduit, dewatering, labor, backfill, sod restoration, coordination, and etc., complete in place. - Price per each
- 16001-8 Core drill existing manhole in earth/existing pavement and connect to conduit system. Includes excavation, saw cutting, concrete, backfill, repair and seal manhole, pavement repair, core drilling, grounding, ground rods, testing, exothermic welds, dewatering, sod restoration, labor and etc., complete in place. – Price per each
- 16001-9 Modification to existing electrical room at Administration Building. Includes modifications, conduit, conductors, concrete, wall repair, paint, core drilling, circuit breakers, testing, labor, coordination and ect., complete in place. –Price per Lump Sum

- 16001-10 Modification to existing airfield vault. Includes modifications, conduit, conductors, concrete, wall repair, paint, core drilling, lighting contactor, photocell, circuit breakers, testing, labor, coordination and ect., complete in place. – Price per lump sum
- 16001-11 New power pedestal for Sheltair Gate, complete. Includes modifications to panel A, identification, conduit, conductors, mounting hardware, loadcenter, circuit breakers, concrete, installation, grounding, grounding rods, channel, splice kits, labor, testing, and etc. complete in place. – Price per lump sum
- 16001-12 Modification to existing Administration Gate Pedestal, complete. Includes identification, conduit, conductors, mounting hardware, modification of pedestal, concrete, installation, grounding, grounding rods, channel, loadcenter, circuit breakers, splice kits, labor, testing, and etc. complete in place. – Price per lump sum
- Add Alternate
- 16001-13 Relocation of existing Administration Gate Pedestal, complete. Includes identification, conduit, conductors, mounting hardware, relocation of disconnect and transformer, concrete, installation, grounding, grounding rods, channel, loadcenter, circuit breakers, splice kits, labor, testing, and etc. complete in place. – Price per lump sum
- 16001-14 One 2" schedule 40 PVC conduit direct buried in earth, complete in place. Includes conduits, connectors, warning tape, excavation, labor, backfill, pull string, conduit spacers, sod restoration, dewatering and etc., complete in place. –Price per linear foot

END OF SECTION 16001

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M, Electrical Products Division;
 - 2. Belden, Inc.

3. TE Connectivity.

- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
1. Advance Products & Systems, Inc.;
 2. Calpico, Inc.;
 3. Metraflex Co.;
 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- D. Cut sleeves to length for mounting flush with both wall surfaces.
- E. Extend sleeves installed in floors 2 inches above finished floor level.
- F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- J. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- L. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance, feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Service Entrance grounding.
 - b. All transformer grounding.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad, sectional type; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. EMT: ANSI C80.3.
- B. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel Set-screw type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.;
2. Anamet Electrical, Inc. - Anaconda Metal Hose;
3. Arnco Corporation;
4. CANTEX Inc;
5. CertainTeed Corp.- Pipe & Plastics Group;
6. Condux International, Inc.;
7. ElecSYS, Inc.;
8. Electri-Flex Co.;
9. Lamson & Sessions - Carlon Electrical Products;
10. Manhattan/CDT/Cole-Flex;
11. RACO; a Hubbell Company;
12. TE Connectivity;
13. Thomas & Betts Corporation.

- C. ENT: NEMA TC 13.
- D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- E. LFNC: UL 1660.
- F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.;
 2. Hoffman.;
 3. Square D - Schneider Electric;
 4. TE Connectivity.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: Screw-cover type Flanged-and-gasketed type.

- F. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman;
 - 2. Lamson & Sessions - Carlon Electrical Products;
 - 3. TE Connectivity.
- C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Prime coating, ready for field painting.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. TE Connectivity;
 - b. Thomas & Betts Corporation;
 - c. Wiremold Company - Walker Systems, Inc.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Butler Manufacturing Company; Walker Division;
- b. Enduro Systems, Inc.; Composite Products Division;
- c. Hubbell Incorporated; Wiring Device-Kellems Division;
- d. Lamson & Sessions; Carlon Electrical Products;
- e. Panduit Corp;
- f. TE Connectivity;
- g. Wiremold Company - Walker Systems.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- E. Nonmetallic Floor Boxes: Nonadjustable, round.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- I. Cabinets:
 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.

2.7 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.8 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - 1. Advance Products & Systems, Inc.;
 - 2. Calpico, Inc.;
 - 3. Metraflex Co.;
 - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: IMC
 - 2. Concealed Conduit, Aboveground: EMT.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: IMC. Includes raceways in the following locations:
 - a. Corridors.
 - b. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Raceways for Optical Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- ### 3.3 INSTALLATION OF UNDERGROUND CONDUIT
- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
 2. Install backfill as specified in Division 31 Section "Earth Moving."
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 33

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Warning labels and signs.
 - 3. Equipment identification labels.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- E. Fasteners for Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- F. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
 - 2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Disconnects.
 - b. Panel covers.
 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
 - c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Disconnect switches.
 - d. Enclosed circuit breakers.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.

- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.

END OF SECTION 26 05 53

SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes Network IP CCTV surveillance cameras, video management software, Ethernet access switches, video management workstation, video monitors, wireless access point bridges, and accessories.
- B. Related Sections:
 - 1. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables;
 - 2. Section 26 05 26 – Grounding and Bonding for Electrical Systems;
 - 3. Section 26 05 33 – Raceway and Boxes for Electrical Systems;
 - 4. Section 26 05 53 – Identification for Electrical Systems.

1.2 DEFINITIONS

- A. List of Abbreviations:
 - 1. AAA Authentication, Authorization, and Accounting
 - 2. AC Alternating Current
 - 3. ARP Address Resolution Protocol
 - 4. ASP Advanced Simple Profile
 - 5. BNC Bayonet Neill-Concelman
 - 6. °C Celsius
 - 7. CAT 5e Category 5e
 - 8. CAT 6 Category 6
 - 9. CCTV Closed Circuit Television
 - 10. CIB Camera Interface Box
 - 11. CMOS Complementary Metal-Oxide Silicon
 - 12. CoS Class of Service
 - 13. CVBS Composite Video Broadcast Signal
 - 14. DC Direct Current
 - 15. DHCP Dynamic Host Configuration Protocol
 - 16. DNS Domain Name Server
 - 17. DVD-RW Digital Versatile Disk Rewritable
 - 18. DVI Digital Video Interface
 - 19. EF Entrance Facility

20.	E-Flip	Electronic Flip
21.	EIGRP	Enhanced Interior Gateway Routing Protocol
22.	°F	Fahrenheit
23.	GHz	Gigahertz
24.	Gbps	Gigabit per second
25.	HD	High Definition
26.	HDMI	High Definition Media Interface
27.	HPoE	High Power over Ethernet
28.	HTTP	Hypertext Transfer Protocol
29.	HTTPS	Hypertext Transfer Protocol Secure
30.	Hz	Hertz
31.	ICMP	Internet Control Message Protocol
32.	IEC	International Electrotechnical Commission
33.	IGMP	Internet Group Multicast Protocol
34.	IRE	Institute of Radio Engineers
35.	IP	Internet Protocol
36.	IPv4	Internet Protocol version 4
37.	IPv6	Internet Protocol version 6
38.	ISO	International Standards Organization
39.	IT	Information Technology
40.	LAN	Local Area Network
41.	LCD	Liquid Crystal Display
42.	Mbs	Megabit per second
43.	MJPEG	Motion JPEG
44.	mm	millimeter
45.	MPEG	Motion Picture Experts Group
46.	MMFO	Multimode Fiber Optic
47.	MTBF	Mean Time Before Failure
48.	MSTP	Multiple Spanning Tree Protocol
49.	NTP	Network Time Protocol
50.	NTSC	National Television System Committee
51.	NVR	Network Video Recorder
52.	ONVIF	Open Network Video Interface Forum
53.	OSPF	Open Shortest Path First
54.	OS	Operating System
55.	PAL	Phase Alternating Line
56.	PC	Personal Computer

57.	PoE	Power over Ethernet
58.	PMP	City of Pompano Beach Airpark
59.	PTZ	Pan/Tilt/Zoom
60.	QoS	Quality of Service
61.	R2	Release 2
62.	RADIUS	Remote Authentication Dial In User Service
63.	RAM	Random Access Memory
64.	RSTP	Rapid Spanning Tree Protocol
65.	RH	Relative Humidity
66.	RTCP	Real-time Transport Control Protocol
67.	RTP	Real-time Transport Protocol
68.	RTSP	Real Time Streaming Protocol
69.	RU	Rack Unit
70.	SAN	Storage Area Network
71.	SD	Secure Digital
72.	SDHC	Secure Digital High Capacity
73.	SMFO	Single-mode Fiber Optic
74.	SDXC	Secure Digital eXtended Capacity
75.	SMTP	Simple Mail Transfer Protocol
76.	SNMP	Simple Network Management Protocol
77.	SP	Simple Profile
78.	SSL	Secure Socket Layer
79.	TACAS+	Terminal Access Controller Access Control System Plus
80.	TB	Terabyte
81.	TBD	To Be Determined
82.	TCP	Transmission Control Protocol
83.	TX	Transmit
84.	UDP	User Datagram Protocol
85.	USB	Universal Serial Bus
86.	V	Volt
87.	VAC	Volts Alternating Current
88.	VGA	Video Graphics Adapter
89.	VMS	Video Management System
90.	VRAM	Video RAM
91.	WDR	Wide Dynamic Range

1.3 SYSTEM DESCRIPTION

- A. Description: Video surveillance system for monitoring of proposed points on one platform as indicated in Drawings. Additionally, provisioning of a wireless network in support of the proposed network video cameras as indicated on Drawings.
- B. Network Infrastructure:
 - 1. Proposed conduit and cable raceways as indicated on Drawings;
 - 2. Proposed CAT 5e cable as indicated on Drawings;
 - 3. Proposed Network Video Management Cabinet as indicated on Drawings;
 - 4. Proposed Wireless Access Point (WAP) Cabinet as indicated on Drawings;
 - 5. Proposed wireless network.
- C. Provide video display assembly at the Air Communications Control Center.
- D. Capacity:
 - 1. Refer to Construction Document Drawings for number of cameras, monitors, wireless units, and WAPs.
- E. Configuration: H.264 (MPEG-4, Part 10), MPEG-4, and MJPEG.
- F. Distribution: Ethernet ports will be 10/100/1000 BASE T via the existing and proposed network for direct connection to edge devices.

1.4 REFERENCES

- A. Governing Agencies, Codes, and Regulations
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing Materials (ASTM).
 - 3. ANSI C2 (2007) – National Electrical Safety Code.
 - 4. Building Industry Consulting Services International (BICSI).
 - 5. CFR 47 Part 15 – Radio Frequency Devices.
 - 6. Code of Federal Regulations (CFR).
 - 7. International Building Code 2006.
 - 8. International Organization for Standardization (ISO).
 - 9. Internet Engineering Task Force (IETF).
 - 10. ISO 9001 – Quality Assurance in Design / Development, Production, Installations, and Servicing.
 - 11. ISO 9003 – Quality Assurance in Final Inspection and Test.

12. ISO 9004 – Quality Management and Quality System Elements Guidelines.
13. National Electrical Manufacturers Association (NEMA).
14. National Fire Protection Association (NFPA).
15. NFPA-70 (2008).
16. NFPA-780 (2008).
17. OSHA – Occupational Safety and Health Agency.
18. OT – Comply with all Office of Technology requirements.
19. UL – Underwriters Laboratory.

- B. The local, county, state and federal regulations and codes in effect as of the start of this contract shall govern all work performed under this project.

1.5 SUBMITTALS

- A. Section 01 33 00 – Submittals Procedures: Reference requirements as specified under the guidelines of this section.
- B. Product Data: Submit catalog data showing electrical characteristic and connection requirements for each component.
- C. Shop Drawings: Indicate electrical characteristics and connection requirements, including system wiring diagram.
- D. Qualifications Statements:
 1. Submit qualification for manufacturer, supplier, and installer.
 2. Submit manufacturer's approval of installer.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of cameras and routing of video cable.
- C. Operation and Maintenance Data: Submit instructions for operating system and performing routine troubleshooting procedures.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years of experience.

- B. Supplier: Authorized distributor of specified manufacturer with minimum three (3) years of experience.
- C. Installer: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

1.8 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Conform to manufacturer's standard service conditions during and after installation of components.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication and procurement.

1.11 MAINTENANCE SERVICE

- A. Section 01 10 00 – Summary: Refer to paragraph 1.3 (E) for Warranty and Maintenance requirements.

PART 2 - PRODUCTS

2.1 VIDEO MANAGEMENT SOFTWARE (VMS)

- A. Manufacturers:
 - 1. Avigilon;
 - 2. ONSSI;
 - 3. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description: Video camera control software system. The VMS solution shall provide centralized management of all CCTV cameras, connected devices, recording servers and redundant servers and provide integration and coordination of integrated physical security, and content analytic(s).
- C. The VMS solution is to serve as a single point of interface. This is to include the

following key components:

1. The VMS is required to integrate the new CCTV surveillance cameras proposed under this project for specified locations designated in plans package.
- D. The VMS solution installed must be configurable, expandable, and have a hierarchy of access levels, user IDs, and passwords.
- E. Video must be stored for a minimum of 30 days.
- F. Existing video storage strategy is to have standard recording at 4CIF resolution, 15 FPS to be increased to 30 FPS on alarm. Final video storage strategy is to be confirmed and approved by Pompano Beach Airpark.
- G. Video data must be in a format suitable for use by law enforcement.
- H. Include video management system workstation at the location as indicated in Drawings.
1. The video management system workstation shall authenticate clients and serve clients with requested video and camera control.
 2. Preferred future authentication method is RADIUS.
 3. The video management system workstation preferred operating system is Windows Server 2008 R2.
 4. The video management system workstation software shall include licenses for all connected video cameras.
 5. The video management system workstation shall provide actual (by camera) or virtual (by server) SNMP management of connected video cameras for camera status.
- I. Include video client software for operating video system.
1. Client software shall enable operators to select view and control pan/tilt/zoom functionality and route video from CCTV cameras via a graphical user interface.
 2. Client software shall enable operators to locate and view archived video.
 3. Shall provide the interface to the video servers.
 4. Client software shall be hosted on PC with Windows 7 Operating System (OS) or later.
 5. The video client software shall include all licenses required to achieve design intent.
- J. The cost of the camera licenses, software, and integration is to be included in the cost of the Video Management System (VMS).

2.2 EXTERIOR FIXED DOME NETWORK VIDEO CAMERA: TYPE A (GATE AND PARKING LOT)

- A. Manufacturers:
 - 1. Avigilon;
 - 2. Axis;
 - 3. Samsung;
 - 4. SONY;
 - 5. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description:
 - 1. Area surveillance exterior 2 MPx Fixed dome network video camera. General purpose, ONVIF (Profile S) conformant, ingress protection (IP66), vandal resistant (IK10) in accordance with the IEC 62262 standard, interior fixed dome full high definition (HD) network video camera. Camera shall support pendent mounting.
- C. Max Resolution: 1920 x 1080 pixels.
- D. Image Sensor:
 - 1. ½” progressive scan CMOS sensor or greater.
- E. Zoom Ratio:
 - 1. Optical: 3x;
 - 2. Digital: 4x.
- F. Lens:
 - 1. Built-in varifocal lens;
 - 2. Horizontal angle of view: 105.2° to 35.4°;
 - 3. Vertical angle of view: 57.0° to 20.0°;
 - 4. Viewing Tilt angle: 127.6°;
 - 5. Focal Length: f = 3.0mm to 9.0mm;
 - 6. F-Number: F1.2 (Wide) to F2.1(Tele).
- G. Wide Dynamic Range (WDR):
 - 1. Shall support capability to produce images with wide dynamic ranges of up to 90 dB where WDR settings change automatically dependent of lighting conditions.
- H. Ratings:

1. Input Power: 12 V DC, 24 V AC, or PoE/PoE+ (IEEE 802.3af /IEEE 802.3at). Six (6) Watts maximum
 2. Minimum Illumination:
 - a. F1.2 Lens: 0.1 lx in color mode, 50 IRE[IP].
 - b. F1.2 Lens: 0.1 lx in black/white mode, 50 IRE[IP] (IR Illuminator ON).
 - c. F1.2 Lens: 0.06 lx color mode, 30 IRE[IP].
 - d. F1.2 Lens: 0.1 lx in black/white mode, 30 IRE[IP] (IR Illuminator ON).
 3. Resolution: Adjustable; 1920 x 1080, 1280 x 720, 1024 x 576, 720 x 576 (PAL), 720 x 480 (NTSC), 704 x 576, 640 x 480, 640 x 360, 352 x 288, and 320 x 185 resolution.
- I. Video Compression:
1. H.264 (High/Main/Baseline Profile);
 2. JPEG.
- J. Video Streaming:
1. Support simultaneous streaming and multiple streams of the same format. Shall be capable of E-flip functionality.
- K. Image Stabilization: Yes.
- L. Operating Temperature: -40°F to +122°F (-40° to +50°C).
- M. Operating Humidity: 20% to 90% (no condensation).
- N. Network Interface:
1. Shall be via an 8-pin RJ-45 connector, 10 Base-T/100Base-TX Ethernet.
 2. Both IPv6 and IPv4 are to be supported.
- O. Users: Minimum of 5 simultaneous users.
- P. Housing: Outdoor.
- Q. Positioning: Cameras must be positioned to minimize any impact on the quality or performance of the video displayed due to light glare.

2.3 EXTERIOR PTZ DOME NETWORK VIDEO CAMERA: TYPE B (AIR FIELD)

- A. Manufacturers:
 - 1. Avigilon;
 - 2. Axis;
 - 3. Samsung;
 - 4. SONY;
 - 5. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).

- B. Product Description:
 - 1. Airfield surveillance exterior 2 MPx PTZ dome network video camera. General purpose, ONVIF (Profile S) conformant, ingress protection (IP66), vandal resistant (IK10) in accordance with the IEC 62262 standard, interior fixed dome full high definition (HD) network video camera. Camera shall support pendent mounting.

- C. Max Resolution: 1920 x 1080 pixels.

- D. Image Sensor:
 - 1. 1/2.8" progressive scan CMOS sensor or greater.

- E. Zoom Ratio:
 - 1. Optical: 30x;
 - 2. Digital: 12x.

- F. Lens:
 - 1. Auto-focus zoom lens;
 - 2. Horizontal angle of view: 63.7° to 2.0°;
 - 3. Vertical angle of view: 38.5° to 1.3°;
 - 4. Viewing Tilt angle: 127.6°;
 - 5. Focal Length: f = 4.3mm to 129.0mm;
 - 6. F-Number: F1.6 (Wide) to F4.7 (Tele).

- G. Pan/Tilt/Zoom: E-Flip with minimum of 60 preset positions.
 - 1. Pan: 360° continuous at 700° seconds⁻¹;
 - 2. Tilt: 220° at 700° seconds⁻¹.

- H. Ratings:
 - 1. Input Power: 24 V AC or HPoE+ (IEEE 802.3af /IEEE 802.3at). 80.0 Watts

- maximum;
- 2. Minimum Illumination:
 - a. F1.6 Lens: 1.4 lx in color mode, 50 IRE[IP];
 - b. F1.6 Lens: 0.15 lx in black/white mode, 50 IRE[IP];
 - c. F1.6 Lens: 1.0 lx color mode, 30 IRE[IP];
 - d. F1.6 Lens: 0.1 lx in black/white mode, 30 IRE[IP];
- 3. Resolution: Adjustable; 1920 x 1080, 1280 x 720, 1024 x 576, 720 x 576 (PAL), 720 x 480 (NTSC), 704 x 576, 640 x 480, 640 x 360, 352 x 288, and 320 x 185 resolution.
- I. Video Compression:
 - 1. H.264 (High/Main/Baseline Profile);
 - 2. JPEG.
- J. Video Streaming:
 - 1. Support simultaneous streaming and multiple streams of the same format. Shall be capable of E-flip functionality.
- K. Image Stabilization: Yes.
- L. Operating Temperature: -40°F to +122°F (-40° to +50°C).
- M. Operating Humidity: 20% to 80% (no condensation).
- N. Network Security:
 - 1. Multiple user access levels with password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, and user log.
- O. Users:
 - 1. Minimum of 5 simultaneous users.
- P. Housing: Outdoor options.
- Q. Positioning: Cameras must be positioned to minimize any impact on the quality or performance of the video displayed due to light glare.

2.4 VMS VIEWING WORKSTATION

- A. Manufacturers:

1. Dell
 2. IBM
 3. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Processor: Intel Xeon (3.2 GHz Six Core)
- C. Memory: 8GB, DDR3 1600MHz RAM
- D. Hard Drive: 500 GB, 10K RPM, SATA III 6GB/s
- E. Video Card: AMD FirePro W5000, NVIDIA Quadro K2000 – 2GB VRAM
- F. Operating Systems: Windows 7 Professional or Windows Server 2008 R2 (based on VMS requirements)
- G. Peripherals: Embedded 8X DVD+/- RW

2.5 VIDEO VIEWING STATION MONITORS

- A. Manufacturers:
1. Dell
 2. Samsung
 3. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description:
1. Type: LED (Backlight)
 2. Screen Size: 24 inches
 3. Resolution: 1920 x 1080 Full HD
 4. Contrast Ratio: 1000:1
 5. Brightness: 250 cd/m²
 6. Inputs: VGA, HDMI , Component Video, Composite Video
 7. Outputs: Audio/Headphone
 8. Max Response Time: 8 ms
 9. Outputs: Audio/Headphone

2.6 VMS CCTV CAMERA NETWORK CONTROLLER (JOYSTICK)

- A. Manufacturers:

1. Samsung
 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description
1. 3-Axis joystick (1 per workstation, total of 5)
 2. Minimum ten (10) Preset PTZ positions
 3. USB interface.

2.7 NETWORK ACCESS SWITCH

- A. Manufacturers:
1. Cisco 2960-X Series.
 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description:
1. Layer 2 Ethernet access switch supporting PoE (IEEE 802.3af) and PoE+ (IEEE 802.3at), 10/100/1000 Base T Ethernet ports, 1G fiber optic links.
 2. Minimum of two (2) 10 Gigabit Ethernet uplink ports.
 3. Support IPv4 and IPv6 routing.
 4. Support multicast routing.
 5. Support TACAS+ and Radius for AAA management.
 6. Support Rapid Spanning Tree Protocol [RSTP].
 7. Support Multiple Spanning Tree Protocol [MSTP].
 8. Support Enhanced Interior Gateway Routing Protocol [EIGRP]
 9. Support Open Shortest Path First [OSPF].
 10. Support Quality of Service [QoS].
 11. Support dual redundant power supplies.
 12. Minimum MTBF > 200,000 hours.
 13. Contractor shall select actual model necessary to achieve site specific design intent and PMP requirements.
- C. Includes all necessary fiber optic transceiver modules, patch cable, cables, and accessory required to a fully functional switch installation meeting PMP requirements and the design intent.
- D. Actual switch configuration selected from this series shall require final approval from the OWNER.

2.8 REMOTE NETWORK ACCESS SWITCH

- A. Manufacturers:
 - 1. Cisco IE 3000 Series.
 - 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description: Ethernet Layer 2 supporting PoE, 10/100/1000 Base T, 1G fiber optic links. Contractor shall select actual model necessary to achieve site specific design intent and PMP requirements.
- C. Includes all necessary fiber optic transceiver modules, patch cable, cables, and accessory required to a fully functional switch installation meeting PMP requirements and the design intent.
- D. Actual switch configuration selected from this series shall be final approval from the OWNER.

2.9 WALL MOUNTED NETWORK VIDEO MANAGEMENT CABINET

- A. Manufacturers:
 - 1. Chatsworth Products Industries (CPI).
 - 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description:
 - 1. Wall mounted 19 inch cabinet with fan and filter kits and 1RU power distribution unit.
 - 2. All components in provided assembly from same manufacturer.
- C. Size and Arrangement: As indicated on Drawings
- D. Cabinet Finish: metallic silver or black.

2.10 POLE MOUNTED WIRELESS ACCESS POINT (WAP) CABINET

- A. Manufacturers:
 - 1. Safetran – Econolite Grou, Inc.
 - 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description:

1. ITS Type 2 Cabinet
 2. Pole mounted cabinet with fan and filter kits and power distribution unit.
 3. All components in provided assembly from same manufacturer.
- C. Size: 46 in. (H) x 24 in. (W) x 22 in. (D).
- D. Arrangement: As indicated on Drawings
- E. Cabinet Finish: metallic silver or black, (anti-graffiti).
- F. Access: Two full-size doors (one front, one rear).

2.11 WIRELESS ACCESS POINT (WAP) ANTENNA

- A. Manufacturer:
1. Proxim – Model Tsunami QuickBridge.11 Series Model 5054
 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description: Wireless bridge bundle utilized to support communication of CCTV cameras back to Air Comm Facility as shown on plans.
- C. Frequency: 2.4 GHz and 5 GHz.
- D. Encryption: 128-bit AES
- E. Input Voltage: 110 to 250 VAC
- F. Operating Temperature: -28°F to 140°F (-33°C to 60°C)
- G. Humidity: Max 100% relative humidity (non-condensing).
- H. Environmental Rating: IP65 rated
- I. Remote Management:
1. Telnet
 2. Web GUI
 3. TFTP
- J. Mean Time Before Failure (MTBF): 100,000 hours

2.12 UNINTERRUPTIBLE POWER SOURCE (UPS) – INTERNAL

- A. Manufacturers:
 - 1. APC – Model SMT1500;
 - 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description: Hardened UPS device to provide back-up power for the network equipment.
- C. Input Voltage: 120 VAC, (50 or 60 Hz selectable)
- D. Output Voltage: 120 VAC, (57 - 63 Hz selectable)
- E. Output Connections: 4
- F. Communication Management:
 - 1. RJ45 (Serial)
 - 2. USB
- G. Rack mountable in 19” rack
- H. Mean Time Before Failure (MTBF): Inverter > 100,000 hrs.

2.13 UNINTERRUPTIBLE POWER SOURCE (UPS) – EXTERNAL

- A. Manufacturers:
 - 1. Alpha – Model FXM1100;
 - 2. Clary – Model SP560;
 - 3. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description: Hardened UPS device to provide back-up power for the CCTV cameras and wireless access point units.
- C. Input Voltage: 120 VAC, (40 – 70 Hz)
- D. Output Voltage: 120 VAC, (50 or 60 Hz selectable)
- E. Operating Temperature: -40°F to +165°F (-40°C to +74°C)
- F. Humidity: 0% to 95% non-condensing

- G. Rack mountable in 19" rack
- H. Mean Time Before Failure (MTBF): Inverter > 100,000 hrs.

2.14 AC SURGE PROTECTOR – EXTERNAL

- A. Manufacturers:
 - 1. ZoneDefender Pro Series;
 - 2. Substitutions: Approved Equivalent (Section 01 25 00 – Substitution Procedures).
- B. Product Description: Compact, high performance surge protector designed for use in industrial applications used to protect equipment from high frequency noise as well as from damaging electrical transients and high-energy disturbances.
- C. Maximum surge current (Imax): 100kA.
- D. Maximum continuous operating voltage: 120 version - 140 VAC.
- E. Frequency Range: 47Hz to 63 Hz.
- F. Operating Temperature: -40°F to +185°F (-40°C to +85°C).
- G. Humidity: 95% RH (non-condensing).
- H. Enclosure: NEMA 4 or greater.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Extend existing video surveillance installations using materials and methods as specified.

3.2 INSTALLATION

- A. Install engraved plastic nameplates in accordance with Section 26 05 53 – Identification of Electrical Systems.
- B. Ground and bond video surveillance equipment in accordance with Section 26 05 26 – Grounding and Bonding for Electrical Systems.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Furnish manufacturer's field representative to supervise final wiring connections and system adjustments.

3.4 ADJUSTING

- A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Adjust manual lens irises to meet lighting conditions.

3.5 ACCEPTANCE TESTING, TRAINING AND COMMISSIONING

- A. Acceptance Testing:
 - 1. The CONTRACTOR shall test all system components furnished and installed to ensure proper operation and configuration. These requirements shall apply to all furnished and installed system components, including, but not limited to all computers, CONTRACTOR provided software, CCTV cameras, network equipment, digital data storage devices, and all ancillary equipment and interfaces.
 - 2. The CONTRACTOR shall develop and submit for OWNER approval detailed acceptance test plans and procedures. The OWNER reserves the right to modify the CONTRACTOR'S test plan or require the CONTRACTOR to add additional operational test procedures so that the procedures effectively exercise all system operations.
- B. System Training:
 - 1. The CONTRACTOR shall provide training on-site on all system elements furnished and installed by the CONTRACTOR. Training shall take place before the system acceptance will be granted.
 - 2. The CONTRACTOR shall submit for approval a detailed description of the training material that the CONTRACTOR is proposing to use, two weeks prior to the date the training is scheduled to start.
 - 3. All training courses shall enable the attendees to be capable of all normal system operations within their respective positions.
 - 4. A minimum of four (4) operator training sessions and 28 sets of training materials are to be provided allocated as follows: seven (7) students each session; one (1) supervisor training session for seven (7) supervisors and three (3) operator training sessions- one (1) at each of the four (4) shifts for seven (7) operators each

- shift. Unused manuals to be provided to the Owner for future personnel.
5. System Administrators shall receive a course detailing the system installation, setup, configuration, database creation, database initialization, database updates as well as system functions and operations. The training course shall include configuration training on all significant aspects of the targeted system/function.
 6. System maintenance training shall be provided detailing procedures and operations of regular and emergency maintenance to the system equipment components.
 7. The CONTRACTOR shall record a training session and provide a training video to the owner.
 8. All system training submittals must include a syllabus as well as the names and qualifications of each person providing the training.
 9. These submittals must be approved by the OWNER prior to training beginning.
- C. Commissioning:
1. Working with the CCTV Control Software provider, the CONTRACTOR shall commission the system at the control center level.
 2. The CONTRACTOR, working in full cooperation with the CCTV control software supplier, shall demonstrate all required system functionality.
 3. The CONTRACTOR shall at completion:
 - a. Demonstrate that all video management functions work correctly.
 - b. Document and obtain concurrence from the OWNER that all required testing is complete.
 - c. Document and obtain concurrence from the OWNER that all required system and control center documentation has been provided.
 - d. Document and obtain concurrence from the OWNER that all training is complete.

END OF SECTION 28 23 00