

SECTION 28 0100

BASIC ELECTRONIC SAFETY AND SECURITY SYSTEMS REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 28.
- B. This section is a Division 28 Electronic Safety and Security Systems section, and is a part of each Division 28 Section.
- C. Requirements of the following Division 28 Sections apply to this section:
- D. Division 28 section 28 0500 "Common Work results for Electronic Safety and Security".

1.02 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01 - reference individual sections for further expansion of these requirements:
 - 1. Abbreviations and Definitions
 - 2. Permits, Codes, and Inspections
 - 3. Visiting Premises
 - 4. Submittals
 - 5. Project Drawings and Specifications
 - 6. Cooperation and Coordination with Other Trades
 - 7. Product Listing
 - 8. Nameplate Data
 - 9. Record Documents
 - 10. Maintenance Manuals
 - 11. Warranty
 - 12. Delivery, Storage, and Handling
 - 13. Sequence of Work
 - 14. Electrical Installations
 - 15. Cleaning
 - 16. Testing
 - 17. Instructions to the Owner

1.03 ABBREVIATIONS

- A. General: Utilize the following abbreviations and definitions for discernment within the Drawings and Specifications.
 - 1. Abbreviations:
 - a. ANSI American National Standards Institute
 - b. ASA American Standards Association

- c. ASTM American Society of Testing Materials
- d. BICSI Building Industry Consulting Services International
- e. CBM Certified Ballast Manufacturers
- f. EC Electrical Contractor
- g. EIA Electronic Industries Association
- h. ETL Electrical Testing Laboratories, Inc.
- i. GC General Contractor
- j. HVAC Heating, Ventilating, Air Conditioning Contractor
- k. ICEA International Cable Engineers Association
- l. IEEE Institute of Electrical and Electronics Engineers
- m. MC Mechanical Contractor
- n. NEC National Electrical Code
- o. NEMA National Electrical Manufacturers Association
- p. NFPA National Fire Protection Association
- q. OEM Original Equipment Manufacturer
- r. OSHA Occupational Safety and Health Act
- s. PC Plumbing Contractor
- t. TIA/EIA Telecommunications Industry Association/Electronic Industries Association
- u. UL Underwriters' Laboratories, Inc.

1.04 DEFINITIONS

- A. WIRING means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.
- B. CONDUIT means the inclusion of all fittings, hangers, supports, sleeves, etc.
- C. CONCEALED means embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.
- D. CONTRACTOR as stated herein shall mean Electronic Safety and Security Contractor.

1.05 PERMITS, CODES, AND INSPECTIONS

- A. General: Contractor shall obtain and pay for all permits and inspections required by laws, ordinances, rules, and regulations having jurisdiction for work included under this Contract, and shall submit approval certificates to the Architect.
- B. Codes: The installation shall comply fully with all local, county, and state laws, ordinances and regulations applicable to local area network and related communication installations.
- C. The installation shall be in compliance with the requirements of the latest revisions of:
 - 1. Building Communication International (BISCI)
 - 2. Telecommunications Industry Association/Electronic Industries Association (TIA/EIA)
 - 3. Occupational Safety and Health Act (OSHA)
 - 4. Institution of Electrical and Electronic Engineers (IEEE)
 - 5. National Electric Code (NEC)
 - 6. Underwriter's Laboratories, Inc. (UL)
 - 7. National Electrical Manufacturer's Association (NEMA)
 - 8. National Electrical Contractors Association (NECA)
 - 9. National Safety Code
 - 10. Legislative Act 235 (1965) - Handicapped

11. Legislative Act 287 (1974) - Excavation
12. International Building Code (IBC) 2003
13. Americans with Disabilities Act (ADA)
14. All approved published instructions set forth by equipment manufacturers.

D. The installation shall be in compliance with the requirements of:

1. Middle Department Inspection Agency (MDIA)
 - a. Exception: Where the regulations of the local municipality require inspection services by an agency other than MDIA.
2. All local codes and ordinances in effect and having jurisdiction.
3. All requirements of electrical power utility companies.
4. All requirements of telephone utility companies.
5. All requirements of cable television utility companies.

E. Submit certificates issued by approved authorized agencies to indicate conformance of all work with the above requirements, as well as any additional certificates as may be required for the performance of this contract work.

F. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architect prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instructions of the Architect and at no additional cost to the Owner.

G. Certificate of Inspection: The Contractor shall procure and pay for the Certificate of Inspection from MIDA, or other required inspection agency, and deliver it to the Architect before final payment is made.

1.06 VISITING PREMISES

A. General: The Bidder shall visit the project site before submitting his/her bid, in order to familiarize him/herself with existing conditions that may affect the work. It is the Contractor's responsibility to analyze existing conditions. Sufficient allowances shall be provided in the Contractor's bid to cover work, due to existing conditions, that will be required to complete this contract work.

B. By submission of a bid the Contractor is attesting that responsible personnel did, in fact, visit the site during the bidding period, and verified all existing pertinent conditions.

C. Contractor shall verify all measurements and dimensions at the site prior to submitting a bid.

1.07 SUBMITTALS

A. General: Follow the procedures specified in Division 1 and as stated below.

B. All nameplate data shall be complete at time of equipment submittals - refer to other sections for identification requirements.

C. For each room or area of the building containing telephone backboards, fire alarm control panels, consoles, etc., coordination drawings are required to be submitted for review and acceptance at the time of the equipment submittal.

D. Equipment shall not be purchased until the shop drawing approval is received.

- E. Shop Drawings shall show conformance with specified equipment characteristics, or Contractor shall assume responsibility for all deviations including all additional costs involved for the deviations.
- F. The following is a list of some important material, equipment and systems that require shop drawing approval, refer to each section of this specification for additional submittal requirements:

Outlet Boxes	Fire Alarm System
Video Surveillance	Security System
Wiring/Cables	
- G. Submittals shall include plan, riser and wiring diagrams complete with all wiring and required equipment.

1.08 PROJECT DRAWINGS AND SPECIFICATIONS

- A. Contractor shall carefully examine the Drawings and Specifications of all trades and report all discrepancies to the Architect in writing to obtain corrective action. No departures from the Contract Documents will be made without prior written approval from the Architect.
- B. Questions or disputes regarding the intent or meaning of Contract Documents shall be resolved by the interpretation of the Architect. The Architect's interpretation is final and binding.
- C. The Drawings and Specifications are not intended to define all details, finish materials, and special construction that may be required or necessary. The Contractor shall provide all installations complete and adequate as implied by the project documents.
- D. Drawings are diagrammatic only and do not show exact routes of cabling and locations of equipment. The Contractor shall verify the work of all other trades and shall arrange his work to avoid conflicts. In the event of a conflict, the Contractor shall obtain corrective action from the Architect.
- E. All work shall be considered new, unless noted otherwise.

1.09 COOPERATION AND COORDINATION WITH OTHER TRADES

- A. This Contractor shall cooperate completely and coordinate work with the contractors of other trades. Due to the Project Schedule this Contractor will be required to phase the installation in accordance with the Electrical Contractor's work.
- B. Prepare floor plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 1. Specific equipment installations, including, but not limited to control cabinets for fire alarm, security, video surveillance systems.
 2. Where additional conduit sleeves are required in order to limit cable lengths.
 3. Wiring diagrams: Indicating field installed wiring and cabling layouts, equipment, and equipment connections.

1.10 PRODUCT LISTING

- A. Prepare a listing of equipment and materials for the project.
- B. Submit this listing as a part of the submittal requirement specified in Division 01.

- C. When two or more items of same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, fasteners, and similar items used in work, except as otherwise indicated.
- D. Provide products that are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplate in an accessible location.

1.12 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01.
- B. When all work has been completed and before final acceptance, the Contractor shall furnish to the Architect a complete set of reproducible contract drawings clearly showing all contract work "as-built". Prior to delivery each drawing shall be signed and dated by the Contractor's project manager attesting to the accuracy of the as-built drawing.
- C. In addition to the above referenced reproducible contract drawings, the Electronic Safety and Security Contractor shall furnish to the Architect a CD-Rom containing all of the floor plans. The floor plans shall be in AutoCAD 2000 format, and shall indicate the "as-built" conditions. A CD-Rom shall be provided to the Electronic Safety and Security Contractor prior the completion of the project, with the drawing files from the bid set of documents. The Electronic Safety and Security Contractor shall make changes to these files, indicating all changes made during construction, including tagging and room names. The Electronic Safety and Security Contractor shall make these changes or retain the services of a third party to make the changes.
- D. Mark up a clean set of Specifications to indicate approved substitutions, change orders and actual equipment and materials used.

1.13 OPERATION MANUALS

- A. Prepare operation manuals in accordance with Division 01. In addition to the requirements specified in Division 01, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's data of each piece of equipment including:
 - a. Installation instructions.
 - b. Drawings and Specifications.
 - c. Parts list, including recommended items to be stocked.
 - d. Complete wiring diagrams.
 - e. Marked or changed prints locating all concealed parts and all variations from the original system design.
 - f. Test and inspection certificates.
- B. Format:
 - 1. Provide five (5) copies of each manual.

2. Manuals to be 8-1/2 inches x 11 inches size in hard back 3-ring loose-leaf binders. Use more than one volume if required. Do not overfill binders.
3. Submit one (1) copy to Architect. After review and acceptance, assemble other copies.
4. Manuals to be completed and in Owner's hands prior to turning building over to Owner and at least 10 days prior to instruction to operating personnel.

1.14 WARRANTIES

- A. Refer to the Division 1 for procedures and submittal requirements for warranties and to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.
- B. Compile and assemble the warranties specified in Division 28 into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.
- D. Submit a single warranty stating that all portions of the work are in accordance with Contract requirements. Warrant all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. Within 24 hours after notification, correct any deficiencies that occur during the warranty period at no additional cost to Owner, all to the satisfaction of the Owner. Obtain similar warranties from subcontractors, manufacturers, suppliers, and sub-trade specialists.
- E. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract Documents or which are damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

PART 2 PRODUCTS

- A. Major items of equipment shall have manufacturer's name, address and catalog number on a plate securely attached in a convenient place. All equipment or apparatus of any one system must be the product of one manufacturer, or approved equivalent products of a number of manufacturer's that are suitable for use in a unified system.
- B. All materials and equipment for which Underwriter's Laboratories have established standards shall bear a UL label of approval.
- C. In all cases where a device, function or item of equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation.
- D. All listed materials and equipment shown on drawings and/or specified herein, are indicative of complete and whole units and shall be furnished as such.
- E. In certain instances specific manufacturer/model/type and catalog numbers are set out herein or on the drawings for the purpose of indicating required criteria for quality, function, and acceptable physical size. Specifications, performance data, and descriptive data published by the designated manufacturer shall be taken as minimum requirements for the item to be provided.
- F. Comply with manufacturer's printed instructions and recommendations as minimum criteria for the installation of equipment.

- G. Where proprietary names are used, whether or not followed by the words "or as approved", they shall be subject to substitution only as approved by the Architect.
- H. Where the contractor proposes substitute equipment he shall submit acceptable evidence to indicate compliance with all requirements of the documents, including performance rating, equivalent to the specified item. In instances where substituted equipment requires additional material or work beyond that shown or required by the specified item, said additional material, or work shall be the responsibility of this Contractor, regardless of the trade involved.
- I. All materials and equipment provided under this Contract shall be completely satisfactory and acceptable in operation, performance and capacity. No approval, either verbal or written, of any drawing, descriptive data, or samples of such materials, equipment and/or appurtenances, shall relieve this Contractor of his responsibility to turn over all items in perfect working order at completion of the work.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.02 SEQUENCE OF WORK

- A. Construct work in a sequence in accordance with Division 01.
- B. Due to current Project Schedule the Contractor will be required to phase the installation in accordance with the Electrical Contractor's work.

3.03 INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for installations of cabling.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
9. Coordinate the cutting and patching of building components to accommodate installation of equipment and materials.
10. Coordinate the installation of materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
11. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

3.04 CLEANING

- A. Refer to the Division 01 for general requirements for final cleaning.

3.05 TESTING

- A. Contractor, at his own expense, shall make any and all tests directed by an inspection authority, or connector manufacturer, or the Architect, and shall provide all equipment, instruments, and materials to make such tests.
- B. Unless otherwise approved, all terminations shall be made and all components shall be in place, complete and operational, at time of final inspection and tests.
- C. Time of such tests, the manner in which they are made and the results of the tests, shall be subject to approval.
- D. Upon completion of work, all component parts, both singularly and as a whole, shall be set, calibrated, adjusted, and left in satisfactory operating condition to suit load conditions, by means of instruments furnished by the Contractor.
- E. Complete testing of equipment and systems shall be provided throughout this project.
- F. Industry standards shall apply except as otherwise specified.
- G. Provide all labor, premium labor, and materials required by field-testing as specified in the Contract Documents and as required.
- H. Notify the Architect seven (7) days prior to the testing dates. Upon completion of a test, a statement of certification shall be forwarded to the Architect for his approval.
- I. Conduct tests at a time agreeable to the Architect. Provide premium labor as necessary.
- J. Products that are found defective or do not pass such tests shall be removed and replaced at the Contractor's expense. Tests shall be repeated.

3.06 INSTRUCTIONS TO THE OWNER

- A. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment

installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

- B. Additional instruction requirements are included in each section of the Specifications.
- C. The Contractor shall video tape all instruction sessions. Prepare a separate video tape for each system as shown on the schedule below. Clearly label the tape with the title "INSTRUCTIONS FOR THE USE OF ", on both the face and the spine, in typewritten letters. Two (2) copies of each video tape shall be given to the Owner at the completion of the Contract; one (1) set for the maintenance staff and one (1) set for the administrative staff.
- D. Prepare an instructional training form indicating the topic of instruction, the date, the time, the purpose of instruction and lines for signatures of attendees. Each person attending the instruction shall print their name and sign the form. Provide a copy of the completed form to the Owner in the O & M manual as proof of instructional training. The Contractor shall keep the original in the Contractor's project file.
- E. The attached schedule indicates the extent of training.

Minimum Instructions to Owner Requirements										
Topic	Spec. Sec. ⁽⁴⁾	Session 1			Session 2			Session 3		
		F ⁽¹⁾	L ⁽²⁾	A ⁽³⁾	F ⁽¹⁾	L ⁽²⁾	A ⁽³⁾	F ⁽¹⁾	L ⁽²⁾	A ⁽³⁾
Access Control	28 1300	I	A/R	A,M	1F	A/R	M	-	-	-
Intrusion Detection	28 1600	I	A/R	A,M	1F	A/R	M	-	-	-
Video Surveillance	28 2300	I	A/R	A,M	1F	A/R	M	-	-	-
Other Systems not listed above : Refer to individual Specification Section										

Notes:

- (1) Format: Provide training in the following format:
 I = initial meeting to discuss system operation, safety issues, maintenance issues
 1F = follow-up session, 1 month from initial session
 2F = follow-up session, 2 months from initial session
- (2) Length: Provide the length of instruction as follows:
 1, 2, 3, etc. indicates the number of hours of training; does not include travel time, setup time, question/answer time.
 A/R=as required by Owner or the number of attendees
- (3) Attendees:
 A = Administrative Staff, as determined by Owner's representative
 M = Maintenance Staff, as determined by Owner's representative
 T = Teaching Staff, schedule multiple sessions to limit instructional session size to 15 people
- (4) Specification Section:
 Refer to the individual specification sections for additional training requirements.

END OF SECTION 28 0100

SECTION 28 0500

COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements of the following Division 28 Sections apply to this section:
- C. Division 28 section 28 01 00 "Basic Electronic Safety and Security Systems Requirements".

1.02 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
 - 1. Firestopping.
 - 2. Locations
 - 3. Scaffolding
 - 4. Painting

PART 2 PRODUCTS

2.01 FIRESTOPPING

- A. Acceptable Manufacturers: Subject to compliance with UL requirements, one of the following:
 - 1. 3M
 - 2. Tremco
 - 3. International Protective Coatings
 - 4. Nelson
 - 5. Rectorseal/Metacaulk
- B. Use only that manufacturer listed in UL Fire Resistance Directory for the UL system involved.
- C. All firestopping materials used on this project shall be the products of one manufacturer. Each trade shall use products of the same manufacturer.
- D. Standards: The firestop systems and products shall have been tested in accordance with the procedures of U.L. 1479 (ASTM E814-81) and material shall be UL classified as Fill, Void or Cavity Materials for use in Through-Penetration Firestops. The firestop system shall comply with NEC Paragraph 300-21. All work shall comply with NFPA 101-Life Safety Code, Latest Edition.

PART 3 EXECUTION

3.01 GENERAL

- A. All construction under this contract shall be completed in a neat and craftsman like manner. Work that, in the judgment of the Architect, is not satisfactorily installed shall be removed and replaced to the Architect's satisfaction, at the Contractor's expense.
- B. Housekeeping: Throughout construction, all work areas and storage areas shall be kept clean. The Contractor shall keep all items clean of dirt, rust, dust, and finger marks.

3.02 FIRESTOPPING

- A. Where communication conduits, conduit sleeves, wire ways and other raceways or cables pass through fire partitions, firewalls, fire floors, or smoke walls, the Contractor shall provide a fire or smoke stopping that provides an effective barrier against the spread of fire, smoke, or gases.
- B. Installation of Fire-Stopping Materials: Install materials to fill openings around services penetrating floors and walls and provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.
- C. All cables that are installed in conduit sleeves or in wire ways through fire or smoke floors or partitions shall be provided with an equally rated re-enterable U.L. listed fire and smoke rated silicone RTV foam in the opening.
- D. Examine fire/smoke-stopped areas to ensure proper installation before concealing or enclosing areas.
- E. Keep areas of work accessible until inspection by applicable code authorities.

3.03 LOCATIONS

- A. Obtain written approval of locations of all devices from the Owner and Architect prior to rough-in/installation. The owner reserves the right to move any or all communication devices prior to installation, at no additional cost.
- B. Contractor shall obtain detailed and specific information regarding location of all equipment. Final locations may differ from those indicated on Drawings. Work improperly placed because of Contractor's failure to obtain this information shall be relocated and reinstalled as directed, without additional costs to the Contract.
- C. The design shall be subject to such revisions as may be necessary to overcome building obstructions. No changes shall be made in location of equipment without prior written approval.

3.04 SCAFFOLDING

- A. The Contractor shall furnish, set, erect, and maintain all scaffolding, aerial equipment, and ladders required in the installation of this Contract work.
- B. Install temporary platforms so as to be supported only by the existing steel truss framework. Do not allow any additional loading from construction operations to transfer to suspended lath and plaster ceilings.

3.05 PAINTING

- A. Except in Mechanical Rooms and Electrical Rooms all exposed items provided or installed under this Contract shall be painted in accordance with Division 1 requirements.
- B. Unless painting is provided by others, as elsewhere specified, all painting for items furnished or installed under this Contract shall be the responsibility of this Contractor.
- C. Factory-painted equipment cabinets and trim shall not be field-painted except for touching up scratches or damage where necessary to achieve like-new finish. Touching up shall be done after equipment is in its final location.
- D. Items to be painted shall be cleaned and degreased and shall be free of dirt, rust and corrosion prior to application of paint.
- E. All paint shall be applied in accordance with all the manufacturer's recommendations (i.e. temperature, dew point, ventilation).

END OF SECTION 28 0500

SECTION 28 0523

CONTROL VOLTAGE CABLING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.
- B. Requirements of the following Division 28 Sections apply to this section:
 - 1. Basic Electronic Safety and Security Systems Requirements.
 - 2. Common Work Results for Electronic Safety and Security.

1.02 SUMMARY

- A. This Section includes cables designed and used for electrical transmission in control, data, and signal circuits including:
 - 1. Twisted Pair cable.
 - 2. Coaxial cable.
 - 3. Video Pair cable.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submittals shall be made with the corresponding system submittal as complete systems including all required accessories and special installation tools (i.e., termination hardware).
- C. Product Data for control/signal transmission cable and connectors, including the following cable transmission characteristics:
 - 1. Mutual Capacitance
 - 2. DC Resistance
 - 3. Characteristic Impedance
 - 4. Attenuation
 - 5. Near-end Crosstalk (NEXT)
 - 6. Nominal Velocity of Propagation
- D. Manufacturers complete installation instructions including the following information:
 - 1. Minimum bend radius
 - 2. Maximum pulling tension
 - 3. Recommended installation of pulling points (i.e., every 180 degrees of bends in the conduit, or every 150 feet of conduit)
 - 4. Recommended pulling lubricants
- E. Product Certificates signed by the communication system manufacturers, certifying that the cables and termination hardware is suitable for the connected equipment and is certified to meet the standards described in Quality Assurance below.

- F. Provide information regarding all termination, splitting and splicing connectors that will be required to complete this installation. This information shall include complete specifications and installation instructions including tightening requirements.

1.04 QUALITY ASSURANCE

- A. Connected Equipment Manufacturer Approval: Where cables specified in this Section are used to provide signal paths for systems specified in other sections of these Specifications or for systems furnished under other contracts, obtain review of the cable characteristics and approval for use with the connected system equipment by the connected equipment manufacturers.
- B. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code."
- C. Toxicity: Comply with applicable codes and regulations regarding toxicity of combustion products of materials used in control/signal transmission media.
- D. UL Compliance: Comply with applicable requirements of UL Standard 910 "Test Method for Fire and Smoke Characteristics of Cables Used in Air Handling Spaces." Provide products that are UL-listed and labeled for such use.
- E. NEMA/ICEA Compliance: Comply with NEMA/ICEA Standard WC 41, "Coaxial Communication Cable."
- F. Comply with the following Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA) Standards:
 - 1. EIA/TIA-568, "Commercial Building Telecommunications Wiring Standard"
 - 2. EIA/TIA-569, "Commercial Building Standard for Telecommunications: Pathways and Spaces"
 - 3. EIA/TIA-570, "Residential and Light Commercial Telecommunications Wiring Standard"
 - 4. TIA/EIA-606, "The Administration Standard of the Telecommunications Infrastructure of Commercial Building"
 - 5. TSB-36, Technical Systems Bulletin, "Additional Cable Specifications for Unshielded Twisted-Pair Connecting Hardware"
 - 6. TSB-40, Technical Systems Bulletin, "Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware"
 - 7. EIA Standards EIA-230, "Color Marking of Thermoplastic Wire" and
 - 8. EIA-258, "Semi-Flexible Air Dielectric Coaxial Cables and Connectors, 50 Ohms."
- G. MIL-SPEC Compliance: Comply with MIL-C-3093, "Telephone Cable; Inside Distribution Wiring," MIL-C-55021, "Twisted-Pair and Triplet Cables; Hookups General Specifications," MIL-C-17/28, "Radio Frequency Flexible Coaxial Cables, 50 Ohms," and MIL-C-17/29, "Radio Frequency Flexible Coaxial Cables, 75 Ohms."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cable factory-packaged in containers or reels. Store in clean dry space and protect products from damaging fumes and traffic. Handle wire and cable carefully to avoid damage.

PART 2 PRODUCTS

2.01 GENERAL

- A. All cable installed in cable tray shall have a plenum rating.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Cable:
 - a. AT&T Network Systems
 - b. The Siemon Company
 - c. Belden Division; Cooper Industries
 - d. Mohawk Wire & Cable Corporation
 - e. West Penn Wire Corporation
 - f. AMP
 - g. General Cable
2. Connectors:
 - a. Thomas & Betts Corporation
 - b. 3M Company
 - c. Blouder Tongue
 - d. Macom
 - e. AMP

2.03 CONTROL/SIGNAL TRANSMISSION CABLE AND CONNECTORS

A. General: Provide control/signal transmission cable and connectors of manufacturer's standard materials as indicated on the drawings. All cables shall be designed and constructed as recommended by the system/equipment manufacturer, for a complete installation and for applications indicated.

2.04 APPLICATIONS

A. Install control/signal cables and connectors for the following systems:

1. For building protection systems
2. Surveillance systems.

PART 3 EXECUTION

3.01 INSTALLATION OF CONTROL/SIGNAL CABLE AND CONNECTORS

- A. Conductors and cables for communications and signal systems shall be installed with a minimum 18" clearance from light fixtures, electrically operated equipment, and all wiring operating at 120 or more volts.
- B. Conductors and cables for communications and signal systems shall be type, size and insulation as recommended by manufacturer and approved. Install in accordance with manufacturer's written instructions and in compliance with NEC.
- C. Coordinate installation with other Work.
- D. Install without damaging conductors, shield, or jacket.
- E. Do not either in handling or installation bend cable to smaller radii than minimum recommended by manufacturer.

- F. Ensure that minimum manufacturer's recommended pulling tensions are not exceeded.
- G. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
- H. Use pulling compound or lubricant where necessary; compound used must be approved by the cable manufacturer.
- I. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- J. No splices are allowed except at indicated splice points.
- K. Use splice and tap connectors that are compatible with media material.
- L. Tighten connectors and terminals, including screws and bolts in accordance with manufacturer's published instructions or torque tightening values.

3.02 COLOR CODING

- A. All wiring for communications and signal systems shall be color coded, using black, red, white, yellow, blue and brown with tracers as required. There shall be no two wires of same trace color in the same cable. This color coding shall be consistent and continuous throughout the system.

3.03 TRAINING

- A. Provide adequate length of conductors within electrical enclosures and at punchdown blocks. Train the conductors to termination points with no excess.

3.04 FIELD QUALITY CONTROL

- A. Prior to usage, test wiring for electrical continuity and for short circuits. In addition, test the cable installation with a time domain reflectometer with strip chart recording capability and anomaly resolution to within one foot in runs up to 1,000 feet in length.
- B. Test all cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.
- C. Documentation: Use the above time domain reflectometer to make a strip chart recording of transmission characteristics, wave form, and performance of all segments of the installation at the time of commissioning. Bind the recordings in a cable record book indexed for easy reference during future maintenance operations and turn book over to the Owner's authorized representative.
- D. Replace malfunctioning transmission media with new materials, then retest until satisfactory performance is achieved.

3.05 COMMISSIONING

- A. Subsequent to hookups of control/signal transmission media, operate control/signal systems to demonstrate proper functioning. Replace malfunctioning media with new materials, and then retest until satisfactory performance is achieved.

END OF SECTION 28 0523

SECTION 28 0529

HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements of the following Division 28 Sections apply to this section:
 - 1. Division 28 Section 28 0100 "Basic Electronic Safety and Security Systems Requirements".
 - 2. Division 28 Section 28 0500 "Common Work Results for Electronic Safety and Security".

1.02 SUMMARY

- A. This Section includes secure support from the building structure for communication items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.
- B. All supports shall utilize threaded fasteners for all connections/attachments. The use of clips or clip-on type supports is not acceptable.
- C. Types of supports, anchors, sleeves, and seals specified in this section include the following:
 - 1. Clevis hangers
 - 2. Riser clamps
 - 3. C-clamps
 - 4. I-beam clamps
 - 5. Conduit straps
 - 6. Round steel rods
 - 7. Lead expansion anchors
 - 8. Toggle bolts
 - 9. Wall and floor seals
- D. Supports, anchors, sleeves, and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other Division-28 sections.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve, and seal.
- C. Shop Drawings: Submit dimensioned drawings of fabricated products, indicating details of fabrication and materials.

1.04 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing supporting device work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of supporting devices.
- D. MSS Compliance: Comply with applicable MSS standard requirements pertaining to fabrication and installation practices for pipe hangers and supports.
- E. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- F. UL Compliance: Provide components that are UL listed and labeled.
- G. FS Compliance: Comply with Federal Specification FF-S-760 pertaining to retaining straps for conduit, pipe and cable.
- H. Components shall be listed and labeled by ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Slotted Metal Angle and U-Channel Systems:
 - a. Allied Tube & Conduit
 - b. American Electric
 - c. B-Line Systems, Inc.
 - d. Cinch Clamp Company, Inc.
 - e. Elcen Metal Products Company
 - f. Greenfield Mfg. Company, Inc.
 - g. Haydon Corporation
 - h. Kin-Line, Inc.
 - i. Midland-Ross Corporation
 - j. Power-Strut Division; Van Huffel Tube Corporation
 - k. Unistrut Diversified Products
 - 2. Anchors:
 - a. Abbeon Cal Inc.
 - b. Ackerman Johnson Fastening Systems Inc.
 - c. Elcen Metal Products Company
 - d. Ideal Industries, Inc.
 - e. Joslyn Mfg and Supply Company
 - f. McGraw Edison Company
 - g. Rawl Plug Company Inc.

- h. Star Expansion Company
- i. U.S. Expansion Bolt Company
- j. Hilti, Inc.

2.02 U-CHANNEL STRUT SYSTEMS

- A. Provide U-channel strut system for supporting communication equipment, 12-gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" diameter holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel and are of the same manufacturer:
 - 1. Fixture hangers
 - 2. Channel hangers
 - 3. End caps
 - 4. Beam clamps
 - 5. Wiring stud
 - 6. Thin wall conduit clamps
 - 7. Rigid conduit clamps
 - 8. Conduit hangers
 - 9. U-bolts

2.03 SUPPORTING DEVICES

- A. Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
 - 1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" diameter hole for round steel rod; approximately 54 pounds per 100 units.
 - 2. Riser Clamps: For supporting 5" rigid metal conduit; black steel; with 2 bolts and nuts; and 4" ears; approximately 510 pounds per 100 units.
 - 3. Reducing Couplings: Steel rod reducing coupling 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.
 - 4. C-Clamps: Black malleable iron; 1/2" rod size' approximately 70 pounds per 100 units.
 - 5. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock, 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
 - 6. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
 - 7. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
 - 8. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
 - 9. Round Steel Rod: Black steel; 1/2" diameter; approximately 67 pounds per 100 feet.
 - 10. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

2.04 ANCHORS

- A. Provide anchors of types, sizes and materials indicated; and having the following construction features:
 - 1. Lead Expansion Anchors: 1/2", approximately 38 pounds per 100 units.
 - 2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.

2.05 SLEEVES AND SEALS

- A. Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:
 - 1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

2.06 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.07 FABRICATED SUPPORTING DEVICES

- A. General: Shop or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide supporting devices that comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Contractor's option.
- B. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installations of supporting devices.
- C. Coordinate with the building structural system and electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- E. Obtain approval from the Architect before drilling or cutting structural members.
- F. Install surface-mounted cabinets with minimum of four anchors.

3.02 MISCELLANEOUS SUPPORTS

- A. Support miscellaneous components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, boxes, and other devices.

3.03 FASTENING

- A. Unless otherwise indicated, fasten items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, cabinets, boxes, and control components in accordance with the following:
 - 1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
 - 2. Holes cut into reinforced concrete beams or in concrete shall not cut reinforcing bars. If the Contractor cuts into any reinforcing bars, stop work and notify the Architect immediately. Fill holes that are not used.
 - 3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

3.04 TESTS

- A. Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:
 - 1. Expansion anchors.
 - 2. Toggle bolts.
 - 3. Powder-driven threaded studs.
- B. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

END OF SECTION 28 0529

SECTION 28 0534

BOXES AND FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 28 Sections apply to this section:
 - 1. Division 28 Section 28 0100 "Basic Electronic Safety and Security Systems Requirements".
 - 2. Division 28 Section 28 0500 "Common Work Results for Electronic Safety and Security".

1.02 SUMMARY

- A. This section includes boxes and fittings for communication installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:
 - 1. Outlet and device boxes.
- B. In general, all outlet boxes, conduit, and raceway shall be provided by the Division 26 Electrical Contractor. The Electronic Safety and Security Contractor shall provide any miscellaneous outlet boxes, conduit and raceway at the communication system racks only. The outlet boxes, conduit, and raceway provided by the Electronic Safety and Security Contractor shall supplement that provided by the EC in order to accomplish a neat and orderly installation.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1.04 QUALITY ASSURANCE

- A. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this section shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
- B. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."
- C. UL Compliance: Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings that are UL listed and labeled.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Standards/Pub No.'s 0S1, 0S2 and Pub 250 pertaining to outlet and device boxes, covers and box supports.
- E. Federal Specification Compliance: Comply with applicable requirements of FS W-C-586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies, and Entrance Caps".

PART 2 PRODUCTS

2.01 BOXES AND FITTINGS - GENERAL

- A. Provide electrical boxes, and fittings of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

2.02 OUTLET AND DEVICE BOXES

- A. Outlet Boxes: Provide galvanized flat rolled sheet steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Provide outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.
- B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Contractor's code-compliance option.
- C. Manufacturers: Subject to compliance with requirements, provide interior outlet boxes of one of the following:
 - 1. American Electric
 - 2. Appleton Electric; Emerson Electric Company
 - 3. Bell Electric; Square D Company
 - 4. Eagle Electric Mfg. Company, Inc.
 - 5. Midland-Ross Corporation
 - 6. OZ/Gedney; General Signal Company
 - 7. Thepitt
 - 8. Hubbell, Inc.
 - 9. Thomas & Betts Company
 - 10. Pass and Seymour, Inc.

2.03 BUSHINGS, KNOCKOUT CLOSURES, AND LOCKNUTS

- A. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes to suit respective installation requirements and applications.
- B. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of one of the following:
 - 1. Adalet-PLM Division; Scott Fetzer Company
 - 2. AMP, Inc.
 - 3. Arrow-Hart Division; Crouse-Hinds Company
 - 4. Appleton Electric Company; Emerson Electric Company
 - 5. Midland-Ross Corp.
 - 6. Midwest Electric; Cooper Industries Inc.
 - 7. OZ/Gedney Company; General Signal Company
 - 8. RACO Division; Harvey Hubbell Inc.
 - 9. Thomas & Betts Company, Inc.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: The Electrical Contractor shall provide all junction boxes for communication devices in walls and floors. The Communication Contractor shall provide any miscellaneous junction boxes required for a neat and complete installation.
- B. Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.
- C. Locations:
 - 1. Install items where required to suit code requirements and installation conditions.
 - 2. Locate and install boxes to allow access. Where installation is otherwise inaccessible, coordinate locations and sizes, and provide required access doors.
 - 3. Locate and install to maintain headroom and to present a neat appearance.
 - 4. Position recessed outlet boxes accurately to allow for surface finish thickness.
- D. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or busing on rounded surfaces.
 - 1. Provide electrical connections for installed boxes.
 - 2. Subsequent to installation of boxes, protect boxes from construction debris and damage.
 - 3. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
 - 4. Support and fasten items securely in accordance with Division 28 Section "Hangers and Supports for Electronic Safety and Security Systems."
 - 5. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
 - 6. Remove sharp edges where they may come in contact with wiring or personnel.

3.02 GROUNDING

- A. Electrically ground metallic boxes and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the box or enclosure.

3.03 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions, and weld marks.
- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating recommended by the manufacturer.

END OF SECTION 28 0534

SECTION 28 0553

IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements of the following Division 28 Sections apply to this section:
 - 1. Division 28 Section 28 01 00 "Basic Electronic Safety and Security Requirements".
 - 2. Division 28 Section 28 0500 "Common Work Results for Electronic Safety and Security".

1.02 SUMMARY

- A. This Section includes identification of communication cables, equipment, and installations. It includes requirements for identification components including but not limited to the following:
 - 1. Identification labeling for cables.
 - 2. Operational instruction signs.
 - 3. Equipment labels and signs.
- B. Refer to Division-01 for equipment and system nameplates, and performance data; not work of this section.
- C. Refer to other Division 28 sections for additional specific identification requirements associated with specific items.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Manufacturer's data for each type of product specified.
- C. Schedule of identification nomenclature to be used for identification signs and labels.
- D. Samples of each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

1.04 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical or communication identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing identification work similar to that required for this project.

- C. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
- D. UL Compliance: Comply with applicable requirements of UL Standard. 969, "Marking and Labeling Systems", pertaining to identification systems.
- E. ANSI Compliance: Comply with applicable requirements of ANSI Standard. A13.1 "Scheme for the Identification of Piping Systems", with regard to type and size of lettering for cable labels.
- F. NEMA Compliance: Comply with applicable requirements of NEMA Standard. No's. WC-1 and WC-2 pertaining to identification of control conductors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following (for each type marker):
 - 1. Ideal Industries, Inc.
 - 2. Panduit Corporation
 - 3. Seton Name Plate Company

2.02 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Adhesive Marking Labels for Raceway and Metal-clad Cable: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service (Control, Fire, etc.).
 - 1. Label Size: as follows:
 - a. Raceways 1-Inch and Smaller: 1-1/8 inches high by 4 inches long.
 - b. Raceways Larger than 1-Inch: 1-1/8 inches high by 8 inches long.
- B. Cable Identification Bands:
 - 1. General: Provide manufacturer's standard plastic wrap-around cable markers, of size required for proper application, and numbered to show cable identification.
- C. Equipment Labels:
 - 1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening.
 - 2. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- D. Lettering and Graphics:
 - 1. General: Coordinate names, abbreviations and other designations used in identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

- E. Fasteners for Plastic-Laminated and Metal Signs:
 - 1. Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers. Exception: Where specifically approved contact type permanent adhesive may be used in areas where screws cannot or should not penetrate substrate.

PART 3 EXECUTION

3.01 GENERAL

- A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- C. Install identification devices as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Regulations: Comply with governing regulations and requests of governing authorities for the identification of work.

3.02 CABLE IDENTIFICATION

- A. Apply cable identification on each cable in each cabinet. Match identification with marking system used on shop drawings, contract documents, and similar previously established identification for project's work.
- B. Each cable shall be marked at both ends.
- C. The Contractor shall review the identification scheme with the Owner prior to commencing work. The identification scheme shown on the floor plans is based on architectural room numbers and may not necessarily be the final post-construction room numbers.

3.03 OPERATION SIGNS

- A. Provide instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.

3.04 INSTALLATION

- A. Provide equipment identification labels of engraved plastic-laminate on each major unit of communication equipment in the building, including each rack, cabinet and main network switch, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each communication system component.

1. Fire alarm master station or control panel.
 2. Security-monitoring master station or control panel.
- B. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION 28 0553

SECTION 28 1100

ELECTRONIC SAFETY AND SECURITY EQUIPMENT GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. This Section includes solid grounding of communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.
- B. The Electrical Contractor shall be responsible for grounding equipment provided in the Electrical Contract, HVAC Contract, Plumbing Contract and General Contract.
- C. The Communication Contractor shall be responsible for proper grounding of all racks, cabinets, and active components as shown on the Drawings and as specified herein.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product data for connectors and connection materials, and grounding fittings.
- C. Field-testing organization certificate, signed by the Contractor, certifying that the organization performing field tests complies with the requirements specified in Quality Assurance below.
- D. Report of field tests and observations certified by the testing organization.

1.04 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with communications grounding work similar to that required for project.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
 - 1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

- E. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).
- F. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to grounding and bonding.
- G. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to grounding.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. B-Line Systems Inc.
 - 2. Burndy Corporation
 - 3. Crouse-Hinds Company
 - 4. Electrical Components Division; Gould Inc.
 - 5. General Electric Supply Company
 - 6. Ideal Industries, Inc.
 - 7. Thomas and Betts Corporation
- B. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
- C. Conductor Materials: Copper with 98% conductivity.

2.02 WIRE AND CABLE CONDUCTORS

- A. General: Comply with Division 26 Section "Low Voltage Electrical Power Cables."
- B. Equipment Grounding Conductor: Green insulated.
- C. Grounding Electrode Conductor: Stranded cable.
- D. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B-3.
 - 2. Assembly of Stranded Conductors: ASTM B-8.
- E. Tinned Conductors: ASTM B-33.

2.03 MISCELLANEOUS CONDUCTORS

- A. Ground Bus: Bare annealed copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.
- C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

- D. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cm. Protect braid with copper bolt hole ends with holes sized for 3/8" diameter bolts.

2.04 CONNECTOR PRODUCTS

- A. General: Listed and labeled as grounding connectors for the materials used.
- B. Pressure Connectors: High-conductivity-plated units.
- C. Bolted Clamps: Heavy-duty units listed for the application.

2.05 GROUNDING ELECTRODES

- A. Signal and Communications: For communication systems, provide a #4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each rack, cabinet or central equipment location.
- B. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
- C. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 EXECUTION

3.01 GENERAL

- A. Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.

3.02 INSPECTION

- A. Installer must examine areas and conditions under which grounding connections are to be made and notify the Architect in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.03 APPLICATION

- A. Provide grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.

3.04 INSTALLATION

- A. General: Ground communications systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.

- B. Coordinate with other electrical work as necessary to interface installation of communication system grounding system with other work.
- C. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

3.05 CONNECTIONS

- A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
 - 2. Make connections with clean bare metal at points of contact.
 - 3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
- B. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

3.06 FIELD QUALITY CONTROL

- A. Upon Completion of installation of communications grounding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 3 ohms, take appropriate action to reduce resistance to 3 ohms, or less, by driving additional ground rods and/or by chemically treating soil encircling ground rod; then retest to demonstrate compliance.
- B. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.
- C. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminal.
- D. Ground/resistance maximum values shall be as follows:
- E. Equipment rated 500 kVA and less: 10 Ohms
- F. Deficiencies: Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated the provisions of the Contract, covering changes will apply.
- G. Report: Prepare test reports, certified by the testing organization, of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION 28 1100

SECTION 28 1600

INTRUSION DETECTION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish and install a complete intrusion detection system with the performance criteria detailed in this specification. The system shall be inclusive of all necessary functionality, monitoring, and control capability as detailed herein and as shown on the plans.
- B. The system shall be completely programmable from any keypad with programming access determined by a level of Personal Identification Number (PIN) code. There shall be no need for a removable programming module of PROM burn to accomplish user-programming changes.
- C. The system supplier shall be a company specializing in the manufacture and supply of intrusion systems with at least (10) ten years of experience and shall have local employees available for support during installation and for final hook-up and acceptance testing.
- D. The catalog numbers specified herein are those of the Ademco Vista series and constitute the type, quality, required operating features, and equipment to be furnished.

1.02 SYSTEM DESCRIPTION

- A. Input/Output Capacity: The system shall be capable of monitoring 87 individual loops or zones and controlling a minimum of 16 output relays.
- B. User/Authorization Level Capacity: The system shall be capable of operation by 75 unique PIN codes.
- C. Operational Options:
 - 1. All/Perimeter System: The user of the system shall be capable of arming and disarming all zones or all zones excluding those zones designated as interior zones.
 - 2. Partitioning: The user of the system shall be capable of selectively arming and disarming any one or more of 8 areas within system based on the user P.I.N.code used. Each of the 87 loops or zones shall be assignable to any one of the 8 available partition areas.
- D. Keypads: The system shall support a minimum of 15 keypads with Alphanumeric Displays. Each keypad shall be capable of arming and disarming any portion of the intrusion detection system. The keypads alphanumeric display shall provide complete prompt messages during all stages of operation and programming of the system and display all relevant operating and test data.
- E. Loop Configuration: The system shall have a minimum of 9 Class B loops available in the control cabinet and support up to eleven (11) 8-input remote modules. All Class B loops shall be 2 wire, 18 AWG minimum, supervised by an End-Of-Line (EOL) device and shall be able to detect open, normal or short conditions in excess of 200 milliseconds duration.
- F. Multiplex Communication: Communication between the control panel, all keypads and remote modules shall be multiplexed over a 4 conductor non-shielded cable. This cable shall also provide power to all keypads, remote modules and other power consuming detection devices.
- G. History buffer: The Command Processor shall contain a 224 event history buffer which can be read at any keypad location. The event buffer shall log all open/close events, alarms and troubles by time and date.

- H. Primary Power: The Command Processor primary power supply shall be a 16 VAC 100VA Wire-in transformer. Plug-in transformers are not acceptable.
- I. Secondary Power: The command Processor secondary supply shall be 12VDC 6AH sealed, lead-acid, rechargeable battery. The battery shall be protected by an automatic circuit breaker. When initially connected to a battery power alone, the control panel shall be protected by a cutoff relay until manually started or primary power is applied. The secondary power shall be float charged at 13.8 VDC at a maximum of 1.2 amps.
- J. Lighting Suppression: The control panel primary power source and incoming telephone lines shall be protected from lightning, power surges, voltage spikes, and transient or RF interference with a combination of zener overvoltage transient suppressors, R/C filters, ferrite beads and spark gaps.
- K. Remote Communication Capacity: The system shall be monitored by an owner selected Central Monitoring Station using a Digital Alarm Communication Transmitter. The system shall be capable of dialing 2 telephone numbers of 20 digits each using the switched telephone network such that if 2 unsuccessful attempts are made to the first number the system shall automatically switch to the second number and make 2 attempts. If these 2 attempts are unsuccessful the system shall switch between numbers after 2 attempts each, until a successful connection is made of a maximum of 10 tries are attempted. Once 10 unsuccessful attempts are made the system shall stop dialing. Should another event occur which requires a message to be transmitted the dialing process the dialing process shall be repeated.
- L. Entry Delay: The system shall permit an entry delay time of (0 to 250) seconds on any loops assigned as exit type loops. When an armed exit type loop is activated, a prewarn tone shall sound and the entry keypad shall display "EnterCode". If a valid user code is not entered prior to the expiration of the entry delay, and alarm will be sounded.
- M. Exit Delay: The system shall permit an exit delay time of (0 to 250) seconds on any loops assigned as exit loops. This exit delay shall be displayed and counted down on the exit keypads alphanumeric display. If any loop is in an alarm condition at the expiration of the exit delay, the entry delay sequence will commence immediately.

1.03 MANUFACTURERS

- A. Equipment in these specifications has been taken from the catalogs of Ademco, as shown, and is intended to denote a standard of quality and type. All published specifications of the manufacturer shall be deemed as being a part of this specification Section, and shall have the same force and effects as if written herewith in full. In order to guarantee the Owner of all factory warranties, all equipment shall be obtained from a local factory authorized vender/ distributor for the jobsite geographical location.
- B. The intent is to establish a standard of quality, function and/or features. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications.
- C. The functions and features specified are vital to the operation of this facility; therefore, Inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Control Pane
 - 1. Furnish and install where shown on the plans an Ademco Vista Model 50P Multiplex Control Panel. The unit shall be a user-friendly system that contains 8 protection loops in the control cabinet. It shall

be capable of communicating with Addressable Initiating Devices and Remote Input Modules (each of which is capable of monitoring 8 protection loops). The system shall support up to fifteen remote keypads. The architecture shall allow the system to be configured either as a perimeter/interior system or as up to eight separately controlled areas within one system. The system shall have provisions for up to 16 outputs and shall include a 7-day clock for time control of outputs.

- B. Keypads: Furnish and install where shown on the plans 6139 Alphanumeric Keypads. The keypads shall provide plain English instructions for operating the Security System. The units shall include the pre-warn tone sounder.
- C. Door monitor switches shall be model 4944SN flush mounted, wide gap style.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Wire sizes and types shall be per manufacturers recommendations.
- B. Install system according to National Electrical Code standards.
- C. Provide a dedicated 120 VAC power circuit with 20 Amp breaker for security system.
- D. Wiring Installation
 - 1. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace and train the conductors to terminal points with no excess. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
 - 2. System Wiring: For the low-voltage portion of the security system, install NO. 18. AWG conductors and 75-deg C insulation in wet, damp, or dry locations. For line- voltage wiring, install No. 12 Awg size with insulation rated 75 deg C minimum.
 - 3. Color Coding: Color-code security system conductors differently from the normal building power wiring. Use one color code for alarm loop wiring and a different color for keypads, sounders, and auxiliary circuits.
 - 4. Wiring to Central Station Transmitter: 1-inch (Size 27) conduit between the Security Control Panel and the central station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as required to suit central-station monitoring function.
- E. Field Quality Control
 - 1. Manufacturer's Field Services: Provide services of a factory-trained service representative to supervise the field assembly and connection of components and the pretesting, testing and adjustment of the systems.
 - 2. Pretesting: Upon completing installation of the system, align and adjust the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
 - 3. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
 - 4. Minimum System test: Test the system according to the procedures outlined by the manufacturer. Minimum required tests are as follows:
 - a. Verify the absence of unwanted voltages between circuit conductors and ground.

- b. Megger test all conductors other than those intentionally and permanently grounded with electric components disconnected. Test for resistance to ground. Report readings less than 1-megohm for evaluation.
 - c. Test all conductors for short circuits utilizing an insulation-testing device.
 - d. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
 - e. Test each initiating and sounding device for alarm operation and proper response at the control unit.
 - f. Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each location including making all possible alarm and monitoring initiations and using all communication options. For each item, observe related performance items at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
5. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

F. Cleaning and Adjusting

1. Cleaning: Remove paint splatters and other spots, dirt and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by the manufacturer.
2. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

G. Demonstration

1. Provide the services of a factory-trained service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - a. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining, of the system. Provide a minimum of 4 hours' training.
 - b. Schedule training with the Owner at least seven days in advance.
 - c. Provide the Owner with a professionally video taped operation and maintenance training seminar for the specific system installed under this Contract. Video training tape shall include all operation, programming, functions, and all aspects of the provided system.

H. Warranty

1. The contractor shall warrant the completed security system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test.
2. The equipment supplier shall make available to the owner a contract proposal to provide ongoing maintenance of the system.

END OF SECTION 28 1600

SECTION 28 2300

VIDEO SURVEILLANCE SYSTEM (“VSS”)

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of the Ocularis OnSSI software and Axis Megapixel Cameras.
- B. Performance Statement: This specification section and the accompanying CCTV-specific Contract Documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- C. Bidders wishing to submit alternate equipment shall provide a complete submittal to the specifying engineer, at least 10 business days prior to bid opening. The submittal shall include a copy of the specification with a paragraph-by-paragraph comparison of the proposed system for all features and functions. The intent of the proposed substitute must be to provide an equivalent system with features and functions equal to the specified system. Contractor must provide all data sheets for each component, a riser diagram showing all system cabling, working drawings, shop drawings with any and all information to allow the specifying engineer to fully evaluate the changes that the proposed substitute will have on this project. Failure to provide any of the above information will result in rejection of the proposed substitution. Alternate supplier contractor must also provide a list of five installations of the identical system proposed which have been in operation for a period of two years. The specifying engineer must approve any alternate system via addendum.
- D. Final approval of the alternate system shall be determined by the engineer and any approved equal will be issued by addendum to allow all bidding contractors to bid using the approved systems

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 28.
- B. This section is a Division 28 Electronic Safety and Security Systems section, and is a part of each Division 28 Section.
- C. Requirements of the following Division 28 Sections apply to this section:
- D. Division 28 Section 28 0500 “Common Work results for Electronic Safety and Security”.
- E. Conduits, Raceway, and Cable Trays Division 27 and Division 28.
- F. Cabling and Wiring Division 27
- G. Data Communications Hardware Division 27.

1.03 REFERENCES

- A. NFPA 70: National Electrical Code
- B. Electronic Industries Association (EIA) Video Surveillance Equipment Standards
- C. UL 2044: Standard for Commercial Closed Circuit Television Equipment
- D. UL 3044: Standard for Safety for Surveillance Closed Circuit Television Equipment

1.04 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey, closed circuit television system.
 - 1. IP Digital Video Management System
 - 2. LCD Monitors.
 - 3. Video Servers Recording and Storage
 - 4. Cameras and Accessories
- B. Performance Statement: This specification section and the accompanying CCTV-specific Contract Documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- C. Basic System Requirements: The CCTV system shall be an IP system and have the following minimum features in addition to those described elsewhere in the Contract Documents:
 - 1. Support an unlimited number of cameras.
 - 2. Multi-site and multi-server configuration.
 - 3. Remote recording and archiving
 - 4. Remote control of motorized pan/tilt/zoom (PTZ) units with automatic positioning capability during alarm events.
 - 5. Support for MJPEG, MPEG4, H263, H264, ONVIF & PSIA standards
 - 6. Programmable partitioning to allow or deny access to selected monitors and cameras from the operator interface.
 - 7. Capability for user defined camera numbers and names to be displayed onscreen with date, time and alarm status for each camera.
 - 8. System architecture shall be microprocessor based with modular, scalable architecture.
 - 9. All date and time functions in the system shall be synchronized in all date/time aware equipment.
 - 10. Shall support an unlimited number of current users without additional licenses fees.
 - 11. Shall support Active Directory

1.05 SUBMITTALS

- A. General: Submit all product data and/or shop drawings bound in a single, soft-cover binder. Incomplete submittals, i.e., missing cameras, computers, racks, equipment, software, Contractor's signatures, etc. will be returned to the sender without any action being taken. The Digital VSS submittal shall comply with the following:
 - 1. Complete listing of ALL equipment, materials, and services that are to be furnished for the work.

2. Typewritten cover page that includes the Contractor's and Supplier's name, addresses, and telephone numbers, and the name of the Project.
 3. Organized and physically divided into sections for each group of items, i.e. separate sections for Image Server, Cameras, etc.
 4. Clearly identify each component item by highlight marker or arrow to define that specific component, all associated characteristics, and all hardware.
- B. Product Data for each component, including detailed manufacturer's specifications.
 - C. Wiring diagrams detailing planned wiring for power, signal and control systems.
 - D. Qualification data for firms and persons bidding on and expected to work on the project. Describe capabilities and experience, and provide references when requested.

1.06 QUALITY CONTROL

- A. The IP Video Surveillance System shall be integrated with the Security Management Access Control System (SMS). The SMS interface shall allow for alarm inputs from Electronic Access Control System to call up video surveillance cameras in the area of troubled device on Call-Up video display and record the event.
- B. The manufacturer shall have five (5) years documented experience.
- C. Installer: The installing dealer must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming. The installing dealer must be able to reference at least 3 projects of similar nature with the video surveillance software and hardware. The installer shall retain a Microsoft MCSE or equivalent technician for the purposes of server deployment, software configuration and system integration. All certifications and integrations must be verified and included with submittals.
- D. Servicing Contractor: The manufacturer of the system must have local service representatives within 60 miles of the project site. The Servicing Contractor shall carry a complete stock of parts. Must have 24/7 available technical support for onsite service. Servicing Contractor must have at least two factory training technicians. Provide all certifications with bid.
- E. All components (DVSS, Computer Hardware, cameras and accessories) must be certified to work in with each other.
- F. Bidder shall include software license for each camera identified on the project drawings and schedules.

1.07 GENERAL SYSTEM AND SYSTEM ADMINISTRATION REQUIREMENTS

- A. IP Network based DVSS- Digital Video Surveillance System ("System") shall allow the display of live, record and playback of digital video streams from multiple video surveillance IP cameras, simultaneously, on the System's operator console and/or on other display and control platforms including clients, virtual matrix display, PDA and Cell phone.
- B. Shall have the option to use Active Directory services to authenticate remote users.
- C. Shall communicate and receive video image streams from IP addressable Cameras using IP protocol.
- D. Shall support traditional analog cameras via video server adapters using IP protocol.
- E. Shall control PTZ cameras using IP protocol.

- F. Shall support IP cameras and encoders using MJPEG, MPEG4, Wavelet H263 and H264 compression simultaneously.
- G. Shall have the ability to view, record, playback and archive video from cameras located at remote locations over the IP network. (Multi-location recordings).
- H. Shall provide the capability to record audio with the associated camera, when audio recording is necessary and the camera has audio feature supported by the software.
- I. Shall simultaneously record, playback and display live video and audio (Triplex).
- J. Shall have the ability to view cameras in higher frame rate than the recording frame rate
- K. Shall allow time synchronized multiple cameras view/playback with motion detection information.
- L. Shall allow the access to view/playback multiple cameras from other workstation on the network.
- M. Shall have the ability to record and store images at rates between 1 frame per hour to 30 frames per second on a per camera basis.
- N. Shall have the ability to store the recorded images on the System's local hard drive or on a Network Attached Storage (NAS), or on attached storage (USB, Firewire, and SCSI) if so required.
- O. Shall support unlimited number of cameras per server, from which maximum 64 can be viewed or recorded by operators at the same time.
- P. Shall be scalable to support any number of cameras with multiple recorders.
- Q. Shall support System redundancy by allowing to switchover a current System to a standby System on an N+1 basis (requires 3rd. party SW)
- R. Shall have automatic (maintenance free) daily archiving capabilities of recorded video with automatic archive recycling.
- S. Shall allow automatic off-premises video archiving on off-premises storage servers.
- T. Shall have video search capabilities to find video images by Time, Date and Activity/Alarm.
- U. Shall provide 24 hours scheduler to activate and deactivate the following features on a per camera basis:
 - 1. Bring cameras on/off line based on the scheduler and conditioned by system events.
 - 2. Ability to activate the Speed-Up feature
 - 3. Send e-mail/text pager/SMS notification on motion detection events with/without video image attachment.
 - 4. Start/stop and change patrolling sequence for PTZ cameras.
- V. Shall provide red Motion Detection indicator light for each camera, to indicate if motion detected by camera when operator left the station and comes back.
- W. Shall provide yellow Event indicator light for each camera, to indicate if event happened on the camera.
- X. Shall have an advanced motion detection capabilities with ALL the functions as described below. The operator shall have the ability to use one, several or any non-conflicting combinations of the following functions, on a per camera basis:

1. Automatically freeze the live video of a camera with no motion in its field of view.
 2. Stop recording camera images with no motion in its field of view.
 3. Start recording images up to 999 seconds before a motion is detected in the camera's field of view and continue recording for up to 999 seconds after the motion stopped in the camera's field of view.
 4. Adjustments of motion level sensitivity from 0 – 10,000 units in 1 unit increments
 5. Adjustments of low light noise levels from 0 – 256 units in 1 unit increments to avoid false motion detection.
 6. Up to 1024 inclusion / exclusion motion detection zones per camera.
 7. Change recorded frame rate when motion is detected.
- Y. Shall have the ability to adjust image resolution to QCIF 160x120, CIF 320x240, VGA (4CIF) 640x480 and up to 2,560 x1,920 lines
- Z. Shall provide the operator with up to 25 presets position per PTZ camera and the ability to quickly cause the camera to move to a preset location upon operator demand.
- AA. Shall have the ability to move a PTZ camera to any of the preset positions upon detecting software command from 3rd. party software (access control).
- BB. Shall have the ability to cause the PTZ camera to go to any of the preset positions on input contact closure/open (such as door sensor, alarm panel input etc.).
- CC. Shall be able to detect close/open relay input from the camera's location and trigger alarm/event on the System.
- DD. Shall have the ability to detect door contacts or PIR motion detector input and cause a PTZ camera to move and zoom into the door and record the activity, to increase protection of sensitive areas.
- EE. Shall provide tamper-proof log file on users' activity in the system using integrity check.

1.08 REMOTE ACCESS VIA PDA

- A. Shall include unlimited PDA Client licenses with the ability to:
1. Monitor and control live fixed and PTZ cameras.
 2. Full PTZ control includes sending the camera to any of the 25 presets.
 3. Select camera, time and date for video playback.
 4. Control playback mode, frame by frame, direction, and speed.
 5. View live and playback cameras at full screen mode.

1.09 REMOTE ACCESS VIA CLIENT SOFTWARE

- A. Shall provide Image server service to allow authorized users to view live video, playback of recorded video and search the archive to view video using installed client software based on .net technology.
- B. The client shall be downloading from the recording server.
- C. Shall include unlimited number of viewer/playback clients able to:
1. Provide username and password for access control into the System.
 2. Define remote user profile and user rights in relation to viewing certain cameras and the use of any function within the client.
 3. Ability to perform immediate playback on any Live camera and go back to Live in one click.

4. Define user profile and views as an individual user or as shared features between multiple users.
5. Monitor up to 64 live cameras on the same screen or on multiple screens.
6. Each camera window can be defined as a live/playback camera, map, fixed image, hotspot, and incoming video alarm window.
7. Each camera will go to full screen by double click on the image.
8. Create unlimited number of views and screen grids, arranged into groups.
9. Control PTZ camera with Point and Click.
10. Control selected supported PTZ camera with USB Joystick.
11. Control PTZ camera setting with buttons on the USB joystick. Controlled functions includes manual focus, iris control and gain control.
12. Control PTZ camera using Keyboard functions including pan, tilt and zoom.
13. Synchronized playback of cameras with forward and backward commands, fast forward, fast backward, forward playback, reverses playback, playback speed control and frame-by-frame commands.
14. Control playback by keyboard inc. frame by frame, next or previous sequence.
15. Digital PTZ on live and recorded image.
16. Have two way audio to and from the camera
17. Find recording using Go-To time and date.
18. Find recording using Alarm / Event list
19. Find recording using "Smart Search". Automatic archive search for activity in a designated area of the image.
20. Preview clip of any alarm/event sequence of a pop up window.
21. Export an AVI file to the client desktop.
22. Print still picture from any camera with operator comments.
23. Change screen grid and cameras locations selected from pull down menu on the fly.
24. Arrange grid and cameras location in logical hierarchy of Groups and Views.
25. Set up camera layout on the grid using drag and drop from the available cameras list.
26. Support IPIX 360 degree recording camera unwrapping with digital PTZ control.
27. Support IPIX camera presets.
28. Control IPIX view using the mouse click and drag on the screen and mouse wheel for zoom in/out.
29. Display 4 independent views from the same IPIX camera and can manipulate PTZ of each view individually.
30. Able to import alarm list for specific camera and view alarm preview clip

1.10 VIRTUAL MATRIX

- A. The Video Management Systems shall provide a Virtual Matrix with the following abilities:
1. Ability to call and camera to any monitor using clickable maps
 2. Ability to select the monitor using point and click on the controller touch screen
 3. Ability to digitally zoom in to any live or archive camera images.
 4. Ability to switch between live and playback on the fly.
 5. Ability to investigate system events from the controller screen, go back in forward in time using the horizontal time line and digital PTZ.
 6. Ability to mark the time line for immediate AVI export, process the closed event in a data base structure with meta data parameters as operator name, event classification, case number, event time, processing time and camera name.
 7. Ability to push live video on event to any of the monitors

1.11 SHALL SUPPORT API FOR INTEGRATION WITH 3RD PARTY SOFTWARE

- A. Shall operate on industry standard Microsoft Windows 2000, 2000 Advanced Server, 2003 server, XP Professional, or .NET operating system with all the controls done via keyboard and mouse.

- B. System shall not include any proprietary hardware such as video capture or frame grabber cards that may cause System instability. System shall be based on industry standard hardware.
- C. All System configurations, changes, setups, and operation shall be available to the System administrator for access and use.
- D. System configurations, changes, setups, and operation shall be password protected.
- E. Preference will be given to plug-and-play, and maintenance free Systems.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The approved DVSS shall be On-Net Surveillance Systems Inc .Ocularis IS with Axis Cameras.
- B. Include all software licenses for all cameras.
- C. Manufacturer's names are listed herein to establish a standard for this project.
- D. Approved manufacture: Video Insight VMS with Axis Cameras.

2.02 VIDEO SERVERS

- A. The Video Server shall be a Windows Server 2008 or current OS with internal storage capacity for surveillance needs.
- B. The video appliance shall be proven in use in supporting new all-IP surveillance needs for future-proof security installations, and/or upgrading existing CCTV DVR implementations.
- C. All equipment and materials used in the video appliance platform shall be standard components that are regularly manufactured and used in the manufacturer's system.
- D. All major components and disk drives shall be enterprise- or server-grade devices, and not commodity- or PC-grade, ensuring improved performance and reliability.
- E. The system shall have been thoroughly tested and proven in actual use with video surveillance systems for physical security, with customer examples.

2.03 VIDEO APPLIANCE PLATFORM - TECHNOLOGY

- A. The video appliance platform shall feature technology designed specifically for physical security and video surveillance needs. The video appliance platform shall:
 1. Set up in minutes, by connecting to cameras or other IP infrastructure and provide the server component for video management software (DVSS) applications.
 2. The DVSS software can be configured immediately, without loading CDs, DVDs or accessing the Intranet, by entering basic system information and the software activation key.
 3. Eliminate the need for commodity storage, by providing the storage component as part of the video appliance device.
 4. Eliminate the need for commodity servers, by providing the server component as part of the video appliance device.

- B. The video appliance shall leverage physical security oriented technology that eliminates commodity servers on a minimum of one server for one appliance basis for standard recording.
- C. Provide a simple, automated setup process from power up through to activation of the preloaded DVSS software without requiring access to the Intranet, CDs, or DVDs.

2.04 VIDEO APPLIANCE PLATFORM - STORAGE COMPONENT

- A. The video appliance platform shall:
 1. Upon completion of the basic startup process, the system should be in a standard Windows environment (initial purchase choice of Windows Vista®, Windows Server 2003, or Windows 2008),
 2. Setup of the DVSS application should be as in a standard server platform, following standard DVSS manufacturer's guidelines.
 3. Have a choice of standard or protected storage.
 4. The protected storage option should eliminate the risk of lost video through advanced RAID (Redundant Array of Independent Disk) level 1 (RAID 5) protection, mirroring the video storage disks.
 5. It should also eliminate the risk of halted recording and playback, by leveraging hot-swap video disk drives.
 6. Offload the Windows Operating System (OS) and Video Management System (DVSS) software onto a separate internal disk drive, eliminating overhead and freeing up all video storage capacity for video recording.
 7. When used to support new, all-IP based surveillance systems, the video appliance platform shall:
 - a. Be certified through a recognized technology lab program and demonstrate connectivity and integration with leading physical security DVSS products.
 8. Servers and storage capacity shall be configured to provide 14 days of storage at 8 IPS at 2592 x 1944 resolution and 30% motion.
 9. Include all licenses for cameras.

2.05 VIDEO APPLIANCE PLATFORM - SERVER COMPONENT

- A. The Video Appliance Platform Server component shall feature at minimum High Performance configurations with Fault Resilient Availability with:
 1. Intel® Quad-Core Xeon® 2.4GHz CPU and optional upgrade to two Intel® Quad-Core Xeon® 3.0GHz, with 4GB.
 2. 8GB DDR2 ECC SDRAM memory.
 3. S1444/1066 MHz system bus.
 4. 8 Hot swappable SAS.SATA 3.5" drive bays.
 5. ATI ES1000 (32MB graphics with 1440x900 maximum resolution) with 1VGA port (optional graphics upgrade available with 2560x1600 maximum resolution with 4 DVI/HDMI ports).
 6. 4 - 2GbE ports.
 7. Internal CD/DVD read drive for data loading, with optional external CD/DVD read/write drive.
 8. Up to 16TB total storage capacity
 9. Two One (1) Ghz Ethernet Cards
 10. 563W AC dual redundant power supplies, 100-240V, 50-60Hz, 8-4 Amp.
 11. Preloaded Windows OS 32 or 64 bit.
 12. 3yr On site manufacturer's warranty.
 13. Systems shall be a major manufacturer of server computers, HP, IBM Dell or Supermicro.

B. High Performance configurations with Fault Resilient Availability shall deliver, while running the selected DVSS application and connected to the external storage component, at a minimum:

1. MJPEG @ 4CIF @ 30fps 30Kbytes Frame Size 1-48 typical IP cameras
2. MPEG4 @ 4CIF @ 2,000Kbits/s Bit Rate 1-80 typical IP cameras
3. H.264 @ 4CIF @ 1,600Kbits/s Bit Rate 1-96 typical IP cameras
4. With optional CPU and memory upgrade
 - a. MJPEG @ 4CIF @ 30fps 30Kbytes Frame Size 1-64 typical IP cameras
 - b. MPEG4 @ 4CIF @ 2,000Kbits/s Bit Rate 1-96 typical IP cameras
 - c. H.264 @ 4CIF @ 1,600Kbits/s Bit Rate 1-128 typical IP cameras

2.06 WORKSTATION CLIENT PC

A. Dell, HP, or IBM PC:

1. CPU: Intel Core2Quad, 2.8 GHz
2. RAM: Minimum 2 GB
3. Operating System: Microsoft Windows XP Professional SP3* or Windows Vista Business*, Windows 7 Business* or Ultimate; all 32-bit or 64-bit running as 32-bit.
4. Dual Graphics Adapter: PCI-Express, minimum 256 MB RAM, Direct 3D supported. 2 GB of dedicated Video RAM are recommended when approaching 64 video channels (either IP cameras or analog cameras connected via video encoder), regardless of the number of monitors used, per client workstation.
5. Software: Microsoft .NET 3.5 Framework and DirectX 9.0 or newer
6. (1) 20" LCD Displays 1080p, resolution

2.07 IP CAMERAS

A. Fixed Dome Axis P3344 Series or approved equal:

1. The camera shall utilize a high sensitivity progressive scan CMOS 1/4" Image sensor.
2. The camera shall have and integrated 2.5-6MM or 3.3-12mm megapixel varifocal lens.
3. The camera shall have an impact resistant aluminum casting dome enclosure, VE models shall include an integrated dehumidifying membrane.
4. The camera shall have a 3-axis gimbal with 360° pan and 170° tilt adjustment for easy and accurate positioning.
5. The camera shall be surface mount with optional pendant mount or wall mount.
6. The camera shall be H.264 (MPEG4,Part 10) and Motion JPEG compliant
7. Be equipped with so called Day/Night functionality and a varifocal DC-iris lens supporting remote zoom and focus.
8. Provide at least 2 streams of resolutions up to 1280x800 pixels at 30 frames per second per stream.

B. The camera shall output at a maximum resolution of 2048(H) x 1536(V) pixels at a maximum frame rate of 30 frames per second (FPS).

C. Minimum Resolution:

1. AXIS P3344/-V/-VE 6mm: Color: 0.3 lux, F1.4, B/W: 0.05 lux, F1.4
2. AXIS P3344/-V/-VE 12 mm: Color: 0.4 lux, F1.6, B/W: 0.06 lux, F1.6

D. The camera's primary power source shall be Power over Ethernet (PoE) complying with the IEEE 802.3af standard.

- E. Accept static IP addresses as well as addresses provided by a DHCP.
- F. Support both IPv4 and IPv6 based addresses.
- G. Operating Conditions:
 - 1. AXIS P3343/-V, AXIS P3344/-V and AXIS P3346/-V: 0 °C to 50 °C (32 °F to 122 °F), humidity 15 - 85% RH (non-condensing)
 - 2. AXIS P3343-VE/P3344-VE: -40 °C to 55 °C (-40 °F to 131 °F), humidity 15 - 100% RH (condensing)
 - 3. AXIS P3346-VE: -40 °C to 55 °C (-40 °F to 131 °F), humidity 15 - 100% RH (condensing)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installing Surge Suppressors: Where AC power-operated devices are not protected against voltage transients by integral surge suppressors specified in UL 1449, install surge suppressors at the device's power-line terminals.
- B. Network connections shall be made only after notification to the Owner's network and/or telecommunications personnel. Network access lines and service shall be provided under Division 27.

3.02 GROUNDING

- A. Connect equipment-grounding connections as recommended by the manufacturer.
- B. Tighten connection to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide appropriate services of an authorized service representative to supervise the field assembly and connection of components and the testing and adjustment of the system.
- B. Inspection: Verify that units and controls are properly installed, connected and labeled and that interconnecting wires and terminals are properly identified.
- C. Pretesting: Align and adjust the system and pretest all components, wiring and functions to verify that they conform to specified requirements. Replace malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- D. Acceptance Test: Schedule tests after pretesting and system has been in normal function operation for at least 5 days.

3.04 CLEANING

- A. Prior to final acceptance, clean system components using methods and materials recommended by manufacturer.

3.05 DEMONSTRATION

- A. Demonstration: Arrange for the services of a factory-authorized training representative to demonstrate server features and functions and train key Owner's technical personnel as appropriate.
- B. Training: Conduct a minimum of two (4 hours total) training Sessions for Owner's employees and authorized users of the Digital Video Security System.

3.06 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within 1 year of the date of Substantial Completion, provide an on-site adjustment of system components and features to optimize performance and customize video capture programs for changing Owner needs. Remote customization shall be provided under the Service Agreement package.

END OF SECTION 28 2300