

**SECTION 270500 - COMMON WORK RESULTS FOR STRUCTURED CABLING AND AUDIO/VIDEO**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions, Divisions 01, 26, 27, and 28 and the following Specifications and Drawings apply to work of this Section.

1. Specification Sections

- |    |         |        |  |
|----|---------|--------|--|
| a. | Section | 270500 | Common Work Results for Structured Cabling and AV  |
| b. | Section | 270510 | Special Requirements for Structured Cabling and AV |
| c. | Section | 271000 | Structured Cabling System                          |
| d. | Section | 274116 | Audio Systems                                      |
| e. | Section | 274117 | Video Systems                                      |
| f. | Section | 274118 | A/V Control Systems                                |

2. Drawings – T series

B. Refer to Divisions 26, 27, and 28 Specifications for coordination information.

1.2 CODES, STANDARDS AND REGULATIONS:

A. All work of Division 27 Structured Cabling, and the works of the related sections shall comply with the latest codes, standards and regulations listed below:

1. National Electric Code (NEC).
2. National Fire Protection Association (NFPA).
3. International Building Code (IBC).
4. Underwriters' Laboratories (UL).
5. National Electrical Manufacturers Association (NEMA).
6. Instrument Society of America (ISA).
7. Institute of Electrical & Electronic Engineers (IEEE).
8. Federal, State and Local Ordinances.
9. Federal Communications Commission (FCC) Regulations.
10. Americans with Disabilities Act (ADA).
11. Federal Communications Commission (FCC) Regulations.
12. Telecommunication Industries Association (TIA).

13. Electronic Industries Association (EIA)
14. American National Standards Institute (ANSI)
15. Building Industry Consulting Service International (BICSI)

- B. In the event of any conflicts between or among different codes or standards, the Contractor shall notify the Design Professional and obtain clarification before proceeding with the work.

### 1.3 SUMMARY OF PROVISIONS IN THIS SECTION

- A. This Section includes:

1. Definition: These specifications and associated drawings refer to the Contractor, defined as the company and its associated employees that are responsible for the work, including but not limited to, installation, connection, testing, certification, start-up, training and close-out of the communications systems.
2. The work requirements of the Contractor is the work defined on the Contract Drawings and in the Specifications for installation, start-up, testing, training, and close-out of the communications systems.
3. The qualification requirements for the Contractor including experience and technical personnel.
4. Definitions and interpretation of the Contract Documents in addition to other sections of the specification.
5. Infrastructure requirements and coordination of the communications systems work with the work of other trades.
6. Cabling and wiring requirements of the communications systems work.
7. Installation requirements of the communications systems.

### 1.4 GENERAL REQUIREMENTS

- A. Provide all work specified on each contract drawing and specification. The contract drawings, specifications, addendums, and bulletins are complementary; what is shown on each contract document shall be provided as if it is shown on all contract drawings and specifications.
- B. The work listed in this section is only a summary of work required for this project. Refer to all contract documents for the complete description of work required.
- C. Refer to general and supplementary contract provisions sections for more details and coordination.
1. Penetrations.
  2. Painting and patching.
  3. Conduits, back boxes, and wire ways.

### 1.5 GENERALIZED DESCRIPTION OF WORK

- A. Audio/Video (A/V)

1. This Contractor is responsible for the A/V work. The Division 27 specialist contractor meeting the requirements of 1.8 Qualifications is responsible for the work.
2. The contractual coordination obligations for the Contractor responsible for the A/V work shall refer to coordination of all infrastructure requirements with all trades.
3. The Contractor is responsible for providing A/V work including, but not limited to, supply, installation, wiring, connections, testing, certification, training, repair, warranty and maintenance of the A/V systems, including installation, labor and materials.
4. The Contractor shall provide all A/V work described in the Division 27 Specifications, shown on Contract Drawings, and related work shown on other drawings. The Contractor shall refer to all Contract Drawings and Specifications for a complete definition of work required. The following is only a generalized summary of work required.
  - a. Provide conductors and cables required for all systems.
  - b. Coordinate with all trades the Division 26 electrical work including infrastructure, wireway, conduit, back boxes, special back boxes, power, receptacles, power distribution strips, and painting and patching.
  - c. Provide A/V Systems as specified under Sections 274116, 274117, and 274118.
  - d. Provide single point grounding of A/V Systems components and circuits.
  - e. Provide all submittals, schedules, and drawings as defined in Section 270510 Special Requirements specifications.
  - f. Provide all testing, certification, start-up, training and closeout as defined in Sections 270500 and 270510 Special Requirements.

**B. Structured Cabling Systems**

1. The contractual coordination obligations for the Contractor responsible for the structured cabling work shall refer to coordination of all infrastructure requirements with all trades.
2. Communications work including, but not limited to, supply, installation, wiring, connections, testing, certification, training, repair, warranty and maintenance of structured cabling system including installation, labor and materials.
3. Provide all Structured Cabling System work described in the Division 27 Specifications, shown on Drawings, and related work. Refer to all Contract Drawings and Specifications for a complete definition of work required. The following is only a generalized summary of work required:
  - a. Provide conductors and cables required for all systems.
  - b. Coordinate Division 26 electrical work including infrastructure, cable tray, wireway, conduit, backboxes, special backboxes, power, power distribution panels, receptacles, and power distribution strips with all trades.
  - c. Provide Structured Cabling System as specified under Section 271000, including but not limited to outlets, cable trays, j-hooks, Cat-6a cabling, fiber optic cabling, patch panels, and equipment racks.
  - d. Provide single point grounding. Coordinate with the Electrical Contractor.

**C. Refer to all other Division 27 Specifications for additional requirements.**

1.6 RELATED WORK

- A. Related work includes, but is not limited to, the following:
  - 1. Miscellaneous steel and hangers required for the support of electrical equipment.
  - 2. Wire labeling and equipment identification as specified herein and elsewhere.
  - 3. Assembly of equipment furnished disassembled.
  - 4. Cleaning of all apparatus specified elsewhere.

1.7 EQUIPMENT NOT-IN-CONTRACT (NIC)

- A. Certain pieces of technology equipment shown on the Contract Drawings are not included within this bid. These items are shown on the Contract Drawings with the identification of “NIC” (Not Included in Contract).
- B. Certain pieces of technology equipment and infrastructure shown in the Contract Drawings are existing and shall be fully integrated into the complete and fully functional solution described by the Contract Documents. Refer to the Contract Drawings and Specifications for additional details specific to each existing piece.
- C. The following technology equipment items are existing or will be provided by the Owner in the future:
  - 1. Computers.
  - 2. Courtroom Recording System.
  - 3. Telephone and data infrastructure and devices.
- D. Refer to the Responsibility Matrix in this section for additional details and requirements of contractual scope responsibilities.

1.8 QUALITY ASSURANCE

- A. Contractor Definition
  - 1. The Contractor, as used in the Division 27 specifications and associated drawings refers to the Contractor with specific qualifications as defined by this section for the installation of these systems.
  - 2. A single Contractor is permitted to perform the Division 27 Structured Cabling System work as well as the Division 27 Audio/Video Systems work provided that the Contractor meets all requirements for qualifications in both roles.
- B. Structured Cabling System Contractor Qualifications:
  - 1. General Requirements: total responsibility for integration of systems, compatibility of all components used, and the coordination and installation of the work shown and described in the Division 27 Specifications.
  - 2. Coordination: Provide and coordinate all work with other trades.
  - 3. Qualification Requirements: The Contractor and their technical personnel performing Communications work shall have a minimum of five (5) years of proven experience in

the installation and servicing of systems of similar size, complexity, and performance. They shall be a certified installer of the telecommunications cable they are installing, thus providing a minimum of 20-year cable plant termination devices and connections warranties. They shall provide three (3) similar projects with contact names and phone numbers. They shall have the following certifications:

- a. Shall be a pre-certified installer of the cable plant. This certification shall extend the manufacturers' warranties for the cable plant, connectivity, components, and labor to a minimum of 20 years. This warranty shall be provided to the Owner at the completion of the project.
- b. Shall employ and assign to the project cable plant installation, connectivity, inspection, testing, and acceptance two (2) registered cabling installation Installers for the duration of the cable plant installation through project close-out. Supply the name of their certified employees with the submission of their qualifications.

**C. Audio/Video Systems Contractor Qualifications:**

1. General Requirements - The Contractor shall have total responsibility for integration of A/V, compatibility of all components used, and the coordination and installation of the work shown and described in the Contract Drawings and Division 27 A/V Specifications.
2. Coordination - The Contractor shall provide and coordinate all work with other trades, including but not limited to conduits, boxes, raceway and related power. This Contractor shall provide equipment, cable, conductors, connections, testing, start-up and training as defined by these specifications.
3. Qualification Requirements: The Contractor's company and their technical personnel performing A/V work shall have a minimum of five (5) years of proven experience in the installation and servicing of complex A/V systems of similar size, complexity, and performance. The Contractor shall provide upon request, three (3) similar projects with contact names and phone numbers. The Contractor shall have the following certifications:
  - a. The Contractor shall be a pre-certified installer of the cable plant and connectivity devices. This certification shall extend the manufacturers warranties for the cable plant, terminations, connectivity, components and labor to a minimum of 20 years. This warranty shall be provided to the Owner at the completion of the project.
  - b. The Contractor shall be an authorized vendor of the manufacturers of systems included in this Contract.
  - c. The Contractor and their staff assigned to manage this project shall be pre-certified for installation, configuration, and programming by the A/V manufacturers of systems included in this Contract.

- D. Product Quality:** The products specified herein were the latest generation at the time of specification and provide the functionality and intent of the system requirements. The Contractor shall provide, at the time of product submittal, the manufacturers' latest generation of products, hardware and software, with equal or greater functionality.

**1.9 DEFINITIONS AND APPLICABILITY TO DIVISION 27 STRUCTURED CABLING AND A/V WORK:**

- A. The definitions of this Section are intended to preserve and expand the applicability of definitions of the General Conditions for all Contract Documents. These definitions are intended to add requirements applicable to Division 27.
- B. In addition to the General Conditions, the following additional definitions shall apply to all Communications Systems work:
  - 1. “PROVIDE” shall mean that the Contractor shall furnish, install, wire, test, adjust, start-up, program, interface, and service all devices required for complete and operational Communication Systems.
  - 2. “INTEGRATION” shall mean that the Contractor shall provide all systems interfacing and programming necessary to physically and logically connect multiple systems through hardware, software, and project specific programming.
  - 3. “PROVIDE CABLING” shall mean that the Contractor shall provide cabling, wire labeling and termination, and coordinate wireway, wire mold, raceways, and conduits as specified for each type of location. Coordinate with requirements of Division 26 for acceptable conduit types.
  - 4. “RESPONSIBILITY OF THIS CONTRACTOR” shall mean the work shall be performed by the Division 27 specialist Contractor(s).

**1.10 INTERPRETATION OF CONTRACT DOCUMENTS**

- A. This Section of the specifications and related drawings describe general provisions applicable to every section of Division 27 Structured Cabling System and A/V Specifications.
- B. No exclusions from or limitations in the language used in the drawings or specifications shall be interpreted as meaning that the devices, connectors, trim, or other appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.
- C. The drawings utilize symbols to indicate various items of work. These do not have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the intent diagrammatically expressed on the drawings and in conformity with the dimensions indicated on final architectural and structural contract drawings and on equipment shop drawings. No interpretation shall be made from the limitation of symbols and diagrams that any elements necessary for complete work are excluded.
- D. The use of words in the singular shall not be considered as limited where other indications denote that more than one item is referred to.
- E. The drawings are diagrammatic and indicate the general arrangement of systems and equipment, unless indicated otherwise by dimensions of detail drawings. For exact locations of building elements, refer to dimensioned drawings; bring all discrepancies between Contract Documents and field conditions to the attention of the Design Professional prior to proceeding with the work. Report to the Design Professional and Owner any discrepancies discovered between A/V drawings and the drawings for other divisions of work.

- F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.
- G. Information as to the general arrangement of construction shall be derived from architectural and structural drawings and specifications only.
- H. The Contractor is responsible for site visits and to participate in the Coordination Drawings prior to installation. Failure to coordinate places the Contractor at risk to responsibility for coordination issues. All discrepancies and coordination issues are to be brought to the attention of the Owner, the Owner's Representatives, and the Design Professional.
- I. The Contract Drawings and Specifications are complementary; what is shown and required on one document shall be provided as if shown and required by all documents.
- J. Provide all materials for systems, resulting upon completion, in functioning systems in compliance with all performance requirements specified. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from furnishing such parts.
- K. Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no additional cost to the Owner. Changes in electrical service to equipment due to substitutions of equipment by any contractors shall be at the cost of that contractor.

**1.11 CONTRACT DOCUMENTS – TECHNICAL REQUIREMENTS**

- A. The Contract Specifications and Drawings complement one another, what is included in one shall be binding as if included in both. Both the Contract Specifications and Drawings are directive concerning the work.
- B. The Contractor shall bid for the systems as shown and specified in the Contract Documents.
- C. The Contractor shall provide all converters, interfaces, line amplifiers, distribution amplifiers, or other equipment required for a fully functional system without increase in cost to the Owner.
- D. The work under each Section of the Specifications shall include all labor, materials, equipment, tools, and services necessary to perform and complete the work described herein and shown on the associated drawings. This includes any incidental work which can reasonably be inferred as belonging to the various systems and necessary in good practice to provide a complete and satisfactory installation.
- E. Titles to Sections of the Specifications are introduced merely for convenience and shall not be taken as a correct or complete segregation of the several units of materials, labor, nor as an attempt to outline jurisdiction procedures. No responsibility, neither direct nor implied, is assumed by the Owner for omissions or duplications by the Contractor, due to real or alleged errors in arrangement of matter in the Specifications.
- F. The Contractor shall coordinate thier work in order to eliminate interferences. Examine, in advance, the locations of mechanical and electrical systems and equipment to be installed and properly coordinate the installation of various components to provide suitable access for operation and maintenance. Where potential or actual interferences exist that cannot be

satisfactorily resolved by the Contractor, he shall bring the situation to the attention of the Owner's Representative and Design Professional before proceeding any further with the work.

- G. Should the Contractor base their bid on systems, equipment, and materials which are different from what is shown and specified in the contract documents, they shall be documented as described herein. All differences whether deficiencies or additional features shall be briefly indicated in the bid and proposal under the heading "EXCEPTIONS TO THE CONTRACT DOCUMENTS".
- H. The Contractor shall provide written report of Contract Document interpretations which contain errors or are in conflict on a "Request for Information" form. The Design Professional and the Owner resolutions to the Contractor's reports are binding and considered part of the contract documents.
- I. The Owner and its representatives shall reserve the right to evaluate all exceptions to the Contract Documents and to decide which solutions will provide the best value for the intended use.

## **PART 2 - PRODUCTS**

### **2.1 SUBSTITUTIONS**

- A. When the Contractor substitutes equipment manufactured by a vendor other than the specified manufacturer, the Contractor shall be responsible for the operation of the product in the intended system, including all related costs required to make the design work, function, and fit in the allocated space.
- B. Refer to Division 01 and General Conditions of the Construction Contract provisions for additional details and requirements.
- C. All substitutions shall, at minimum, meet the performance requirements specified within these specifications.
- D. All substitutions shall be provided at a lower cost to the Owner than the products specified and the credit must be offered with the substitution submission.
- E. The Contractor shall submit all data necessary to prove that the substitute products meet the performance requirements shown on the Contract Documents.
- F. The Contractor shall submit all requests for substitutions to identify the following:
  - 1. Specification section, paragraph, model, and manufacturer of the product specified.
  - 2. Suggested substitute including model and manufacturer and each component required, including quantities.
  - 3. Credit to the Owner.
  - 4. Complete product data, including cut sheets, manufacturer specifications, application diagrams and installation details.

5. Description of the reason why, in the Contractor's opinion, substitution is recommended. Description and details for installation of the substitute product as specifically required for this project.
6. Technical description of equivalent performance and any deficiencies.

## 2.2 MANUFACTURED PRODUCTS

- A. All equipment and materials provided shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories listing where subject to Underwriters Laboratories label service. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of five (5) years.
- B. Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible.
- C. Performance as delineated in schedules and in the specifications shall be interpreted as minimum acceptable performance.
- D. Materials and equipment provided shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available. Technologies advance at a faster rate than design, bid, and construction. Therefore, provide the current model of each piece of equipment specified.
- E. When more than one unit of the same type of equipment or material is required, such units shall be the products of a single manufacturer.
- F. Equipment Assemblies and Components:
  1. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Design Professional and Owner.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.
  5. Moving parts of any element of equipment of the unit normally requiring lubrication, shall have means provided for such lubrication, and shall be adequately lubricated at the factory prior to delivery.
- G. All factory and field wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- H. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling unless indicated otherwise.

**2.3 CABLING AND WIRING REQUIREMENTS**

- A. All cabling shall be in conduit, wireway, or approved raceway. Coordinate all infrastructure requirements with other trades.
- B. All cable support devices required for proper installation shall be provided by the Contractor whether explicitly shown on the Contract Documents or not.
- C. All cable support devices shall be submitted to the Design Professional for approval prior to installation.
- D. Do not run low voltage, signal, or control wiring in same conduit/raceway as for electric power cables. Cables for door locks are power cables. Provide separation from lighting fixtures and other electrical appurtenances. Provide electrical interference protection circuits as required to maintain the specified signal quality and as required by system manufacturers.
- E. Use separate junction boxes and enclosures for individual low voltage systems cabling. Junction boxes and conduit shall be color coded for identification of the internal system cabling.
- F. Cable management support systems shall be segregated between low voltage systems cabling and power cabling. Cables shall be color-coded to identify within the cable management system the identity of each system. This color shall match the associated conduits and junction boxes used for the same systems.
- G. Provide and maintain pull strings / tapes / ropes in all conduits for future installation of additional cabling. Pull in new pull strings with wire.
- H. Submit a wire-marking scheme to uniquely identify each wire in the system.
- I. Provide multi-conductor cables with all conductors marked. Multiple-pair cable shall have each pair marked.
- J. Provide cable marking at each panel, at each device, and at any junction box.
- K. Provide markers to indicate zone number, circuit number, cable number, and devices served.
- L. Provide a wiring legend to indicate what the wire marking code means. This chart shall identify each and every wire in the system.
- M. All wire colors, marking, legend, zones, circuit numbers and identifications shall be provided on the As-Built documentation.
- N. Provide cabling as described in each Section for each system/device.

**2.4 WIREWAY WIRE MANAGEMENT**

- A. Coordinate the cable requirements for proper size and loading requirements of the wireway system.

- B. Enter and exit any wireway system per Division 26 specifications, using standard wiring, safety and workmanship standards. Refer to Contract Drawings and conduit requirements for more information.
- C. Install color-coded systems wire within any wireway system for easy identification.

## 2.5 CONDUIT WIRE MANAGEMENT

- A. Provide all ancillary conduits as required, unless provided under Division 26. The Contractor shall refer to the Division 26 specifications for conduit specifications and provide similar type for ancillary runs.
- B. Coordinate the cable requirements for proper size and fill requirements of the conduit system prior to purchase or installation.
- C. Enter and exit the wireway systems, junction boxes, etc., per Division 26 specifications, using conduit. Refer to contract drawings and Division 26 specifications for more information.
- D. Color code conduit labeling system for easy identification of system contained within.
- E. Install firestop around any conduit passing through fire partitions, firewalls, and floors. Refer to specifications in this Division as well as the specifications of Division 26 and Division 07.
- F. Install pull strings into every conduit in which cable is installed.

## 2.6 CABLE AND WIRE LABELING

- A. Provide heat shrink type, scratch resistant, oil resistant, smear resistant, indelible labeling through a Portable Computerized Labeling System.
- B. All cables and individual wiring shall be uniquely labeled with indelible markings, which remain intelligible when and after contact with water and oil. All cables shall be labeled at all connection points, junction, pull boxes, Server Rooms / MDF's, IDF's, and wiring closets. All individual wires shall be labeled where accessible in cabinets, junction boxes, and pull boxes.
- C. Cabling and wiring logs shall be maintained for all cabinets, junction and pull boxes. The cabling log shall identify all accessible cabling whether connected or passing through. Refer to systems specifications for additional requirements.
- D. Provide labeling through a computerized permanent labeling system.
- E. The Contractor shall fully inform themselves of the Owner's cable labeling standards prior to the start of work. The Contractor shall re label any or all cabling until the Owner is satisfied, at no additional cost to the Owner.

## 2.7 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the National Electrical Code, install an identification sign which will clearly indicate information required for use and maintenance of items such as cabinets, control devices and other significant equipment.

- B. Nameplates shall be laminated white phenolic resin with a black core and engraved lettering, a minimum of ¼" high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions. Affix with rivets or other approved fasteners. Glue, tape, or cement is not approved.
- C. All letters shall be upper case, of uniform height, centered on device, coverplate, or enclosure. Engraved letters shall be filled with a contrasting color made clearly and distinctly.

## 2.8 COMMUNICATIONS AND DATA CONNECTIONS AND SPLICING

- A. The system wiring shall allow for easy and efficient connection, splicing, and servicing.
- B. Provide DIN rail mounted UL listed connectors in all junction boxes, cabinets, racks, and wire management where splicing is required.
- C. The Contractor shall ensure that all cables meet the signal transmissions, speeds, switching, and processing specifications as stated by manufacturer's literature for the cable and intended use and purpose. All splices and connections shall be performed by only certified installers. All splices shall be checked for proper installation, dressing and connections. Any cables not meeting the manufacturer's minimum requirements shall have all splices and connections redressed and reconnected. If splicing and connections are proven not to be the problem, then the cable shall be replaced.
- D. For 12-volt to 48-volt low voltage power conductors, only pressure crimped, punched down, insulated, butt-end, or through-splice connectors shall be used.
- E. All communication plates shall be coordinated with and match the electrical receptacle and switch plates. The color shall be confirmed with the Architect and Owner.
- F. For data grade connectors, i.e., Category-6A, use only UL- and cabling manufacturer-approved UTP grade 'RJ' connectors. All connectors shall match the rating of the corresponding cabling, and shall be acceptable to the manufacturers.

## 2.9 FIRE STOPPING

- A. Provide code-required fire stopping at all fire rated wall, floor, and partition penetrations with UL listed fire stopping materials. All penetrations of fire-resistance-rated construction shall be protected using listed and approved through-penetration firestop assemblies. Refer to specifications in this Division as well as the specifications of Division 26 and Division 07 – in particular section 078413 Firestops and Smoke seals.

## 2.10 SOUND RATED PARTITIONS

- A. To inhibit sound transmission at STC rated partitions comply with recommendations of the Gypsum Association's Fire Resistance Design Manual, Section III, and the following:
  - 1. STC rated partitions shall be air tight.
  - 2. Openings for fixtures, devices, equipment, conduit, piping, ductwork, etc. shall be treated with flexible sealant at the perimeter of the penetrating device.
  - 3. Recessed fixtures, devices, equipment, etc. shall not be located back-to-back or in the same stud cavity.

4. Holes within penetrating items, such as knock-outs or wire penetrations at electrical boxes, shall be sealed with flexible sealant in a manner which will not be visible in the completed work.
5. Continuous sound attenuation batts shall be maintained around the penetrating item.
6. Where available space requires that penetrating items be placed back-to-back or within the same stud cavity, seal items with sound attenuating putty.
7. Where a fire rating is also indicated, sealants and putty shall comply with requirements of UL rated assembly.

#### 2.11 SURGE PROTECTION FOR EXTERIOR WIRING

- A. Provide surge protection at/with the terminal boards and connectors for each tele/data copper wire entering or exiting a building.
- B. Provide Building Entrance Terminals indoors in equipment rooms at the point of cable entrance or exit from the building.
- C. Building Entrance Terminals (BET) shall be comprised of a heavy duty, premium quality cabinet with a cover, wall or frame mounted, cable raceway, internal splice chambers, cable connection or punch down, and surge protection modules.
- D. Provide appropriate type connectors for cables.
- E. BET shall be equipped with an internal fuse link and external ground connectors.
- F. BET shall meet or exceed UL497.
- G. Refer to Section 271000 Structured Cabling System for additional details and requirements for Cat-6a cables.
- H. Manufacturers: Subject to compliance with requirements, provide products by Circa Enterprises Inc, Avaya, Siecor, AT&T, Ditek, L-Com, or approved equal.

#### 2.12 SURGE PROTECTION FOR ELECTRONIC EQUIPMENT

- A. Surge/Lightning Protection – All electrical circuits supplying power to system components for which infrastructure is provided under Division 27 Specifications shall be equipped with surge protectors. Coordinate installation and to verify that protectors are installed properly. Division 26 shall provide and install surge protectors on all underground signal circuits.
- B. The surge protection shall meet the following minimum performance requirements:
  1. Spike dissipation: 180 Joules.
  2. Spike voltage: 6000 V, clamping at 225 V.
  3. Spike current: 15000 A.
  4. Clamping response time: <5 nanoseconds.
  5. Noise rejection frequency range: 150 KHz to 100 MHz.
  6. Noise protection: transverse and common modes.

7. Leakage to ground: <10 mA.

- C. The power line conditioners shall provide the number of outlets necessary for all equipment and service outlets required for effective servicing.
- D. Manufacturers: Subject to compliance with requirements, provide products by Leviton, Hubbell, United Power, Furman, SurgeX, APC, or approved equal.

#### 2.13 GROUNDING AND ISOLATION

- A. Provide single point grounding of the individual systems as recommended by IEEE, BICSI, and system manufacturers.
- B. Provide in each rack, a copper busbar as a ground unipoint for connection of grounding conductors used for the equipment in that rack.
- C. Coordinate with the Division 26 Contractor to provide connection of each rack's busbar to the ground busbar in the circuit breaker panel using #4 AWG insulated copper conductor.
- D. Provide connection of each rack's ground busbar to the rack frame by means of a tightly attached lug. Connection shall be made between lug and ground busbar using minimum #12 AWG stranded wire, type TW.
- E. Coordinate with the Division 26 work all electrical power, grounding, and surge protection as required to meet the provisions of NFPA 70 - National Electric Code, Article 250-74 for isolated ground type installations.
- F. Provide grounding of underground distribution systems as required by National Electric Code. Provide cabling plant ground of maximum 25 ohms, measured in normally dry conditions, not less than 48 hours after a rainfall. Where a 25-ohm reading cannot be obtained, provide additional ground rods connected to the existing rods. Ground rods shall be copper-clad steel, 3-meters x 19-mm diameter.
- G. Coordinate grounding requirements with other trades and Contractors to preclude closing of ground loops via peripheral equipment supplied from different electrical power sources. Provide isolation transformers and other equipment as required.
- H. Contractor shall be required to correct ride-through hum from any and all sources as well as from dissimilar audio ground levels to "zero dB" to obtain completely inaudible system noise floor at full audio gain.

#### 2.14 ENVIRONMENT

- A. All equipment shall be installed in accordance with the manufacturers' environmental specifications. The most stringent manufacturers' requirements for any piece of equipment in any location shall be the requirements for the entire room, closet, or enclosure, even if those requirements are greater than those listed in these Specifications.
- B. Coordinate with other trades for the installation of all air conditioning, humidifying, air filtering, and any other room conditioning system required to meet all environmental specifications.

- C. Ambient temperature in all rooms, closets, or enclosures containing communications system equipment shall not exceed 80 degrees Fahrenheit. Coordinate all ventilation and air conditioning required.
- D. Relative humidity in all rooms, closets, or enclosures containing communications systems equipment shall be within the range of 10% to 80% non-condensing. Coordinate all humidifying and dehumidifying equipment required.
- E. All rooms and closets containing communications systems equipment shall have all seals and air filtration systems necessary to maintain manufacturers' restrictions on airborne particulate size and concentration. All enclosures shall be rated for providing the necessary level of protection from airborne particulate and water. Coordinate with other trades to provide all necessary airborne particulate and water minimization equipment and seals.

#### 2.15 ACCESS DOORS

- A. Include all access doors required by codes or local conditions. All access door locations shall be approved by the Owner.
- B. The minimum access door size acceptable is 12" x 12" of clear opening.
- C. The access doors shall meet the requirements listed below:
  - 1. Fire rated as required for each location.
  - 2. Key operated cam lock.
  - 3. Prime finished steel construction.
- D. The access doors shall be maximum security, heavy-duty steel doors. Coordinate with the Architect and General Contractor for approved finishes and colors.
- E. Manufactures: Subject to compliance with requirements, provide products by Milco, Gordon, Inc., Armstrong, Acudor, manufacturer matching the Architect's ceiling specifications, or approved equal.

#### 2.16 PLENUM MOUNTED EQUIPMENT

- A. All equipment mounted in ceilings that are HVAC plenums shall be rated for such installation or shall be mounted in an enclosure which is listed for plenum use.

#### 2.17 RESPONSIBILITY MATRIX

- A. The Responsibility Matrix indicates the minimum required responsibility of all referenced parties. Lack of a specifically noted responsibility on the matrix shall not relieve the Contractors from the responsibility to provide complete and fully functional systems. In cases where there are multiple parties responsible for a particular item, it shall be the responsibility of the General Contractor to coordinate all efforts until completion has been approved.
- B. Entity Legend:
  - 1. OWNER – The Owner

2. CONTRACTOR – The Contractor(s) performing the Division 27 work and their qualified subcontractors meeting the requirements of the specifications.

C. Abbreviations:

1. Tele/Data – Telephone and Data Communications
2. A/V – Audio Video Systems

See Responsibility Matrix on the following page:

<b>Item</b>	<b>Furnish</b>	<b>Install</b>	<b>Configure</b>
Tele/Data Cat-6A and Fiber Optic Cabling, Outlets, and Connectors	CONTRACTOR	CONTRACTOR	CONTRACTOR
Tele/Data Cat-6A and Fiber Optic Patch Panels	CONTRACTOR	CONTRACTOR	CONTRACTOR
Tele/Data Cat-6A and Fiber Optic Patch Cabling	CONTRACTOR	CONTRACTOR	CONTRACTOR
Tele/Data Equipment Racks and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
Tele/Data Uninterruptible Power Supplies (UPS's)	CONTRACTOR	CONTRACTOR	CONTRACTOR
Tele/Data Cable Supports, Raceways, and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
Tele/Data Network Switches	OWNER	OWNER	OWNER
Wireless Access Points and Controllers	OWNER	OWNER	OWNER
Wireless Access Point Outlets	CONTRACTOR	CONTRACTOR	CONTRACTOR
Telephones and Telephone System	OWNER	OWNER	OWNER
Tele/Data Servers, Routers and Security Devices	OWNER	OWNER	OWNER
Computers, Printers, Copiers, and all other Tele/Data equipment not listed	OWNER	OWNER	OWNER
A/V Outlets, Cabling, and Connectors and Patch Panels	CONTRACTOR	CONTRACTOR	CONTRACTOR
A/V Equipment	CONTRACTOR	CONTRACTOR	CONTRACTOR
A/V Network Switches	OWNER	OWNER	OWNER

**PART 3 - EXECUTION**

**3.1 INSPECTION AND PREPARATION OF WORK:**

- A. Prior to any work, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the contract drawings and specifications, and the referenced standards.
- C. Return to original condition any finished areas disturbed during system installation.

**3.2 INSTALLATION**

- A. Install all equipment in accordance with the manufacturers' recommendations.
- B. Demonstrate all equipment and placement to the Owner prior to installation.
- C. Secure equipment using fasteners suitable for the use, materials, and loads encountered. Submit evidence providing suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
- D. Equipment location shall be as close as possible to locations shown on contract drawings. As required by field coordination with other trades, or as directed by the Design Professional, the Contractor shall provide wall, console, furniture, millwork mounted, or ceiling mounted devices with no additional cost to the Owner.
- E. Working spaces shall be at minimum as specified in the National Electrical Code for all voltage specified, but not less than three (3) feet.
- F. All equipment shall be installed in location and manner that will allow for convenient access for maintenance and inspection.
- G. Coordinate location of equipment and conduit with other trades to minimize interference.
- H. Routing shall be laid out in advance. Develop detailed coordination drawings to identify use of chases, spaces above ceiling, and Mechanical / Electrical / Security / Electronic Rooms prior to drilling through structural sections for determination of proper layout. Routing shall be located so as not to affect structural sections such as ribs or beams.
- I. Where conduits, wireways, and other raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke, and gases. Firestop material shall be packed tight, and completely fill clearances between raceways and openings. Firestop material shall be in accordance with reference codes standards, regulations, and contract documents.
  - 1. Floor, exterior wall, and roof seals shall be watertight. Walls and floors which are cored for installation of conduit shall be sleeved with steel tubing, grouted and the space between the conduit and sleeve filled as required by Codes and Standards.
  - 2. Tubing shall extend minimum one (1) inch above finished floor.

- J. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factor of 5, which shall conform to any specific requirements as shown on the drawings or in the specifications.
- K. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage.
- L. Damage from rain, dirt, sun, and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.
- M. Conduits shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.
- N. During construction, cap the top of all conduits and raceway installed vertically.
- O. During installation, equipment shall be protected against entry of foreign matter on the inside; and be vacuumed cleaned both inside and outside before testing, operating, and painting. Provide painting selected by the Owner.
- P. Damaged equipment, as determined by the Owner or Design Professional, shall be repaired or replaced and returned to operating condition at no additional cost to the Owner.
- Q. Painted surfaces shall be protected at all times. Protection shall be removed prior to final inspection.
- R. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer at no additional cost to the Owner.

### 3.3 PROTECTION

- A. The Contractor shall protect, at their own expense, thier work, materials or equipment as is liable to injury during the construction period. All openings into any part of associated fixtures, equipment, etc., both before and after being set in place, shall be securely covered or otherwise protected to prevent injury due to grit, dirt, or any foreign matter. The Contractor shall be held responsible for all damage so done.

### 3.4 EQUIPMENT SUPPORTS

- A. Where supports, stands, etc. are required, indicated, or specified, supporting steel of sufficient strength to safely withstand the loads involved and to properly distribute the load over the building area shall be the responsibility of the Contractor subject to the approval of the Design Professional. All exposed cabinets shall be mounted on framing systems to allow air circulation behind them.
- B. Necessary mounting steel, bolts, washers, etc., for all equipment is included as required under this Specification, whether explicitly indicated or not.

- C. Expansion bolts and shields shall be used to secure equipment, fixtures, etc. to solid masonry. Toggle bolts shall be used for hollow masonry, plaster or tiles. Wood or plastic plugs will not be permitted.

### 3.5 FIELD QUALITY CONTROL

#### A. Adjusting, Testing and Cleaning:

1. Substantial Completion requirements are as follows:
  - a. All systems shall be completed and operational, and all controls shall be set and calibrated at SUBSTANTIAL COMPLETION.
  - b. All testing, start-up, and cleaning work shall be complete at SUBSTANTIAL COMPLETION.
2. All bright metal or plated work shall be thoroughly polished. All temporarily pasted labels (except warning/ID labels), dirt, and stains shall be removed from the devices.
3. All testing shall be coordinated with and approved by the Owner. Certification from the Contractor that the installation is complete and fully operable shall be forwarded to the Owner. The certification shall include the names and titles of witnesses of the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance to make necessary adjustments related to the testing. The Contractor shall be required to perform testing of individual devices and complete system testing, including but not limited to:
  - a. All start-up, testing and certification shall be as outlined in Sections 270510 Special Requirements.
  - b. All systems function properly and trouble-free as outlined in Division 27 specifications.
4. All testing as described under this section, shall also conform to all of the requirements as set forth under Section 270510, Special Requirements.
5. Clean all equipment, construction debris and dust, etc. and leave all equipment in a “like new” condition. Proper precautions shall be in effect to protect dimmer packs and control console from airborne particles. In the event particles have entered the mechanisms, a “professional” cleaning of the equipment shall be provided at no cost to the Owner with proof required.

### 3.6 SYSTEMS CERTIFICATION

- #### A. The Contractor shall be responsible for Total Quality Control Management for all work provided. Provide certification of the following in regards to the systems.
1. The Contractor shall inspect, test, and adjust systems as required to meet the operational, performance, and reliability requirements. When all systems are operating as specified, the Contractor shall schedule and organize joint testing with Design Professional and Owner.
  2. The Contractor shall provide joint testing and certification with the Owner and Design Professional.

3. The Contractor shall submit complete Certifications and test results. The Contractor shall provide a separate certification for each system. Refer to section 270510 for System Certification Forms.
  4. The system certification shall attest that the system provided meets the operational criteria established by the Contract Documents, the recommendations of the manufacturers, and the requirements of codes, standards and regulations applicable for the system.
  5. A manufacturers' certified representative shall be present during each System Testing and Certification.
- B. After all final tests and adjustments have been completed and approved by the Design Professional/Owner, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Manufacturer's representative shall conduct training on specialized electronic systems as described herein.
- C. The Contractor shall submit separate recommended inspection, testing, and preventative maintenance procedures for each system.

### 3.7 SUBSTANTIAL COMPLETION

- A. Schedule Substantial Completion visit with the Owner and Design Professional at a mutually agreed time. Contractor shall notify the Owner and Design Professional a minimum of two (2) weeks in advance of the intended substantial completion inspection time.
- B. Should any part of a system fail during the substantial completion tests to perform according to the Contract Documents, the entire system shall be retested at a Owner selected time and date.
- C. Correct deficiencies unacceptable to the Owner and provide a complete and functional system.
- D. Record and submit to the Owner the final test results as specified herein.
- E. Acceptance: Systems will not be accepted by the Owner until deficiencies have been corrected.
- F. Beneficial use of systems by Owner shall not be considered as an acceptance.
- G. Should additional expense occur to the Design Professional due to repeated reviews, such expense shall be reimbursable to the Design Professional from the Contractor. This shall not be construed as a penalty but as additional project related time because the Contractor's failure to correct the work properly has made the additional review(s) necessary. In the event of such additional expenses, the Design Professional will furnish evidence of such expenses to the Contractor.

### 3.8 WARRANTY

- A. Cable plant, connectivity components and splices extended warranty for installation by a certified Contractor shall be provided. The minimum warranty required is 20 years. The Contractor shall supply the actual warranty offered by the manufacturer for the certified installation. Extended warranty must include cable plant, connectivity and labor.

- B. All work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the work of all other Trades resulting from same, shall be replaced or repaired as directed by the Owner's representative.
- C. The Contractor shall provide to the Owner the written warranty that the cable plant, connectivity installation, labor including controls and all other equipment covered under each section of the specifications, performs in an efficient and satisfactory manner.
- D. The Contractor shall warranty all phases of the system including, but not limited to, software, hardware, peripheral equipment for a period of two (2) years from the date of written final acceptance against defective materials, design and workmanship. The Contractor shall not be responsible for warranties on the equipment provided by the Owner. The Contractor shall include all preventive maintenance, parts, and servicing required for the systems provided under Division 27 specifications to be continuously operational. The Contractor shall provide all parts required for warranty service, in addition to spare parts specified in which are intended to be used by the Owner for non-warranty servicing. Upon receipt of notice from the Owner of failure of any part of the guaranteed system, the Contractor, with the assistance of the supplier, shall promptly replace or repair the defective component to restore an acceptable system at no cost to the Owner.
- E. The warranty period shall commence upon signed final acceptance by the Owner. Acceptance tests and procedures shall be developed by the Contractor and accepted by the Design Professional/Owner.
- F. During the warranty period, there shall be no charges to the Owner for service calls including mileage, materials, labor, travel expense, etc. for warranted work. The Contractor shall also submit itemized warranty costs for each year after the initial warranty period.
- G. The costs associated with warranty provided by the Contractor shall not be paid to the Contractor with the construction costs. The Owner shall pay for satisfactory warranty servicing semi-annually after completion of each semi-annual service period. The Contractor shall submit costs and documentation required for Owner's budget planning and contract management.

### 3.9 MAINTENANCE AND SERVICE

#### A. Maintenance and Service

- 1. This service shall consist of supplier's factory trained representative providing the following:
  - a. Personnel factory trained and/or certified by the manufacturers of the system's components.
  - b. Authorized representative of the manufacturer and have an agreement of factory support.
  - c. Provide onsite inventory of spare parts to support the "Systems Response Requirement" listed below. Spare parts to be stored at the facility. Spare parts shall remain the property of the Owner after expiration of the manufacturer's or contractors service period.
  - d. Five (5) years' experience minimum servicing systems of the type included in this project.

- e. Capability of making additions or changes to the software systems used in this project.
  - f. Capability of servicing the individual system components and the total integrated system.
  - g. All test equipment.
- B. Service Requirements - Guarantee service response requirements shall include the following:
- 1. 24-hour phone number.
  - 2. Service organization shall have a telephone response time of not more than two (2) hours between the hours of 8:00AM and 8:00PM, in the time zone of the project location, Monday through Friday.
  - 3. Service organization shall be able to restore the system to full service and operation within forty-eight (48) hours after being notified.
  - 4. Shall maintain current set of system documentation including but not limited to the following:
    - a. Wiring diagrams.
    - b. Operation and maintenance manuals.
    - c. Software programs.
    - d. Other documentation as required to provide assistance to the Owner's qualified technical representative on the operation and maintenance of the systems.
    - e. All documents shall be made available to the Owner upon request.
    - f. Upon termination of maintenance agreement, all system documents, or copies of such, shall be furnished to the Owner for maintenance continuity.
    - g. All system documents, software and related information shall be the sole property of the Owner, and on loan to the Contractor.
- C. Provide technical personnel and spare parts conveniently located, to ensure that the Mean Time to Service/Repair (MTTS), of any malfunction/system failure to be maximum forty-eight (48) hours. MTTS shall be defined as the required time to return the malfunctioning system to normal operations, calculated for any three month period.
- D. Refer to Division 01 and General Conditions of the Construction Contract for additional warranty and service details and requirements. If any discrepancies exist, the more strict requirements shall be required.
- 3.10 CORRECTION OF WORK, FINAL PAYMENT, AND WARRANTY
- A. Final payment shall not relieve the Contractor of responsibility for faulty equipment, materials, and workmanship and, unless otherwise specified, they shall remedy any defects due thereto and pay for any damage to other work resulting therefrom, which shall appear in the Warranty period.
  - B. Include guarantees and warranties by the respective equipment manufacturers, which shall be subject to the terms and time limits defined under this Article of the Specifications. Each completed and accepted system shall be guaranteed by the Contractor.

- C. Guarantees and warranties furnished by Sub-Contractors and/or equipment manufacturers shall be counter-signed by the Contractor for sole responsibility to the Owner.
- D. Manufacturers' equipment guarantees or warranties extending beyond the warranty period described herein shall be transferred to the Owner along with the Contractors' warranties.

END OF SECTION 270500

**SECTION 270510 – SPECIAL REQUIREMENTS FOR STRUCTURED CABLING AND AUDIO/VIDEO**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Specification.
- B. Refer to all Contract Drawings and Specifications listed in Section 270500 for additional requirements.
- C. Refer to Divisions 26 and 28 Specifications for coordination information.

1.2 CONSTRUCTION SCHEDULE

- A. Refer to General Conditions and Requirements. Comply with GC requirements to submit a construction schedule, provide to them the information necessary to produce an accurate and obtainable schedule.

1.3 SUBMITTALS

- A. General: Comply with requirements of Division 01 and all Bid Documents requirements.
- B. All Contractors performing work described by the Division 27 specifications shall be required to follow all requirements of specifications sections 270500 and 270510, as well as the specific requirements of each individual Division 27 section which describes the work that they shall perform.
- C. All shop drawings, submittals, catalog cuts, equipment datasheets, calculations, and as-built documentation shall be stamped approved, signed, and dated prior to forwarding to Design Professional. Unsigned documents shall be returned unreviewed for such stamping.
- D. Any delays resulting from inappropriate submissions will be the responsibility of the Contractor.
- E. Submit all documents as outlined in the various Division 27 specifications, including but not limited to the following:
  - 1. Not later than 60 days after Notice to Proceed, or as required by the General Conditions of the Contract or Division 1 specification, submit the following as one complete submittal:
    - a. Contractor and personnel qualifications. Refer to specifications section 270500 item 1.8 for additional details and requirements.
    - b. Shop drawings, product data, bill of materials, riser diagrams, details and point-to-point wiring diagrams. Refer to items 1.4 and 1.5 for additional details and requirements.
    - c. Details of the warranty that shall be provided for all items furnished by the Contractor.

- d. All schedules, test plans and procedures, spare parts lists and requested samples. Refer to item 1.4 for additional details and requirements.
  2. At least two weeks prior to requesting Substantial Completion Inspection, submit the following as one complete submittal:
    - a. As-Built drawings. Refer to item 1.12 for additional details and requirements.
    - b. Fully completed testing reports showing that all required items are installed, configured, and tested with passing results. Refer to items 1.7, 1.8, 1.9, and 1.10 for additional details and requirements.
    - c. At least three (3) business days prior to scheduled onsite testing with the Design Professional and Owner, the A/V Contractor shall submit the final audio configuration file(s) for review. Refer to item 1.10 for additional details and requirements.
  3. Not later than 30 days after Substantial Completion and prior to requesting Final Completion Inspection, submit the following as one complete submittal:
    - a. Final As-Built drawings. Refer to item 1.12 for additional details and requirements.
    - b. Operation, Programming, and Maintenance Manuals and all training materials. Refer to items 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, and 1.19 for additional details and requirements.
    - c. Certification and Warranty Documents. Refer to items 3.4, 3.5, and 3.6 for additional details and requirements.
- F. Refer to Table 270510-2 Submittal Register and specific submittals listed in each Division 27 Section.

#### 1.4 PRODUCT DATA MANUAL

- A. Prior to release of any materials, the Contractor shall submit the product data manual together with the shop drawings as required by the project schedule.
- B. The Contractor shall submit acceptable equipment for review by the Design Professional and the Owner. The Contractor shall bear all liability and penalties for damages arising from their failure to submit equipment that meets these specifications, including, but not limited to, any liabilities and penalties for failure to meet construction deadlines.
- C. Divide the manual to include a separate chapter or volume for each specification listed in Division 27. Reference Contract Document identifications for Specifications and Drawings. For hardcopy manuals, provide dividers with labeled tabs. For electronic manuals, provide a table of contents with hyperlinked section titles.
- D. Final determination of compliance with these specifications shall rest with the Design Professional and the Owner, who, at their discretion, may require proof of performance at the cost to the Contractor.
- E. The Product Data Manual shall include items and references listed as follows:

1. Contractor and assigned personnel qualifications information. Refer to specifications section 270500 item 1.8.
2. A complete narrative description of the systems. This description shall be comprehensive in that it will describe the total functionality of all of the systems and relating equipment. The systems description shall be used by the Design Professional for the purpose of evaluating the Contractor's equipment and materials submission and the Contractor's understanding of the installation, operation, and intent of the systems.
3. Work schedule detailing how the Contractor will meet the contractual obligations on time in coordination with the GC, with other trades, and with the Owner's scheduling.
4. Bill of materials including quantities, manufacturers, model numbers, brief descriptions, and list prices for all products to be used in the project.
5. Manufacturers' data sheets for the specific products that will be used for this Project. On each data sheet, indicate the specific model that will be provided.
6. Calculations, graphs, and tables to show and substantiate required quantities, capacities, runtimes, loads, and similar.
7. References to applicable codes, standards, and regulations.
8. A/V Control System Graphical User Interface software screenshots showing each and every control screen and button with description of function and use. These screen shots may alternatively be provided as part of the Shop Drawings. Refer to item 1.5 for additional details and requirements.
9. Spare Parts Manual - Submit spare parts manual containing list of recommended spare parts, equipment and materials. The spare parts list shall include all parts that can render a system in one or multiple buildings inoperable as described in Division 27 Specifications and any parts that are not in the service organization's inventory and cannot be delivered to the site within 24 hours. For each item listed, provide the information listed below.
  - a. Manufacturer's name, address, phone number.
  - b. Manufacturer's model, series, version, and GSA number, as applicable.
  - c. Mean time before/between failure (MTBF).
  - d. Number of devices of same type used for this project and number of spare parts recommended to be stored on the site.
  - e. Current approximate delivery time.
  - f. Current list price.
  - g. Product data and description of operation, including list of equivalent parts, if applicable.

#### 1.5 SHOP DRAWINGS

- A. Submit the product data manual together with the shop drawings as required by the project schedule.

- B. The Shop Drawings shall be created and produced by the Contractor using AutoCAD, Revit, or similar industry-standard computer aided drafting (CAD) or building information modeling (BIM) program. Submissions using scanned or copied portions of the Contract Documents shall be rejected without review. The Contractor shall be permitted to utilize the blank Architectural AutoCAD and/or Revit floor plans and ceiling plans if they are released by the Architect for such purposes.
- C. The Shop Drawings shall be produced through a coordinated effort among all trades and shall show required coordination details. Refer to specifications section 270500 for additional details and requirements for coordination with other trades. The Contractor shall be responsible for any associated costs or delays caused by failure to perform the necessary coordination.
- D. Reference Contract Document identifications for Specifications and Drawings.
- E. In addition to the technical proposal submittal requirement of the Common Work Results for Communications, all work shall be based on approved Shop Drawings and referenced product data.
- F. The Shop Drawings shall include items and references listed as follows:
  - 1. A drawing index listing each drawing number and title.
  - 2. A symbols and abbreviations sheet defining each symbol and abbreviation used in the shop drawing set. Do not include symbols or abbreviations which will not be used for this project.
  - 3. A master cabling schedule listing manufacturer, model, and brief description for each cable type used in this project. This shall correspond with all cable types used for all connections shown throughout the shop drawings.
  - 4. Cable labeling and color coding schemes definitions. This shall correspond with all cable labels and numbers used for all connections shown throughout the shop drawings.
  - 5. Floor plans and ceiling plans showing each: field device, equipment room, control room, control jurisdiction, and major cable path.
    - a. All field devices shall be shown in their coordinated, dimensioned, intended location. If the typical field device will be provided as per typical installation details, a reference to the associated installation details drawing shall satisfy the dimension requirement.
    - b. Each field device shall be labeled with a unique identifier that indicates the device type and any unique properties, the location of the field device, and the associated equipment room. These unique identifiers shall be used across all drawing types (floor plans, diagrams, details, schedules).
    - c. Each equipment room and control room shall be called out with a reference to a larger scale detail plan - refer to requirements below for details.
    - d. Each major cabling path shall be represented. Include indication of the quantities and types of cables that shall use each main path. Indicate cable support type and penetrations where applicable.
  - 6. Point to point diagrams indicating the required equipment, cabling, and cable labeling.

- a. Each and every device and piece of equipment shall be individually represented on the system diagrams - diagrams showing only “typical” connectivity shall not be accepted. Individual tele/data outlets shall not be required to be represented individually on the diagrams.
  - b. Lines with appropriate cable/wire label annotations shall be used to show all required connectivity between all devices and pieces of equipment.
  - c. Devices and equipment shall be neatly grouped according to their physical location. For example, all equipment within the main equipment room shall be shown inside of a rectangle labeled to indicate that it represents the main equipment room.
  - d. All devices, cables, equipment, enclosures, and rooms shall be clearly labeled.
7. Equipment and termination wiring details including indication of the type of termination for each cable, conductor, and cable shield. Diagrams/details showing termination details which are typical for many similar instances shall be acceptable.
  8. Single point grounding diagrams and details indicating ground bus bars, ground lugs, conductors, panels, and grounding rods as applicable.
  9. Installation details for each typical device and piece of equipment including dimensions in reference to site and building elements, references for material type, color, and aesthetic integration as required. Include mounts, fasteners, hardware, supports, and sealing as applicable.
  10. Control room and equipment room plan layout/configuration details including dimensions, details, and references for color and aesthetic integration. Indicate all equipment, enclosures, consoles, desks, racks, clearances, wireways, cable supports, and penetrations as applicable.
  11. Scaled equipment rack and enclosure elevation details including rack units or dimensions where applicable, equipment types and quantities, blank spaces for airflow, and open space for equipment furnished by the Owner where applicable.
  12. All installation details shall reflect ADA requirements regarding height, type of function, accessibility, and other applicable ADA guidelines. As part of the close-out documents, the Contractor shall provide a statement that it has complied with ADA requirements.
  13. Calculations, graphs, and tables to show and substantiate required quantities, capacities, runtimes, loads, and similar.
  14. A/V Control System Graphical User Interface software screenshots showing each and every control screen and button with description of function and use. These screen shots may alternatively be provided as part of the Product Data Manual. Refer to item 1.6 for additional details and requirements.

#### 1.6 DEMONSTRATION - SOFTWARE

- A. Within the schedule shown on the Installation Schedule, and with sufficient time to be able to receive review comments and make adjustments as required, the A/V Contractor shall submit screenshots and written functionality descriptions of the A/V touch screen control screens, menus, and buttons for review by the Design Professional and Owner.

- B. The screenshots and descriptions shall include a view of each and every screen, menu, and button, with an accompanying written description of function. The control screens shall clearly illustrate control for each A/V device specified, and how the operator will be prompted to accomplish the proper sequence of operations as indicated in the Division 27 specifications. Provide enhancement of software and/or hardware which performs unsuccessfully or does not meet the requirements specified.
- C. As an option, in addition to the screenshots with descriptions, the Contractor may elect to deliver a physical touch screen control panel loaded with the full intended graphical user interface to the Owner for review. If this option is selected, the touch screen demo shall be exactly representative of the intended final installation, but shall not be required to receive or send any signals to any other equipment for the purpose of the demo.
- D. After all corrections have been made based on the review comments, the Contractor shall resubmit to the Design Professional and Owner for approval. Approval shall not relieve the Contractor of providing all functionality and meeting all requirements of the Contract Documents.
- E. At least one (1) week prior to the scheduled start of onsite audio work, the Contractor shall submit the audio configuration file(s) for review. At the time of this submission, all input and output gain, acoustic echo cancellation, mixing, auto-mixing, routing, level adjustments, dynamics processors, and logic shall be configured. Filters and equalization shall be included in the appropriate signal paths as placeholders to be finalized during onsite room audio tuning. Approval shall not relieve the Contractor of providing all functionality and meeting all requirements of the Contract Documents.

#### 1.7 SYSTEM TEST PROCEDURES

- A. System Tests: Perform tests based on standards for each category of cable as specified by the IEEE 568 document. Tests of twisted pair cabling shall be performed with a minimum of a Level III tester and to the specifications for the cable type.
- B. Test procedures shall be developed by the Contractor using the associated standards. The test procedures shall describe the test instruments used, conditions of tests, when tests are scheduled and who will perform each test for all devices, cabling and end-to-end testing of all systems. Test procedures shall be submitted and approved prior to proceeding with tests.
- C. When factory testing is specified, provide the information listed below.
  - 1. The Design Professional shall have the option of witnessing factory tests. The Contractor shall submit for approval the test procedure and notify the Design Professional a minimum of 15 working days prior to the manufacturer making the factory test.
  - 2. Submit two (2) copies of certified test reports containing test data to the Design Professional for approval prior to final inspection and not more than 90 days after completion of tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be responsible for additional expenses.
- D. Manufacturers shall provide factory testing as required.

- E. Provide products that meet the minimum performance and reliability requirements specified for each system and component.
- F. Mean Time Before / Between Failures (MTBF) for each system component shall be minimum 50,000 hours of operation unless specifically indicated otherwise.
- G. Refer to each section within the Division 27 specifications for test procedures which are specific to each subsystem.

#### 1.8 TEST PROCEDURES MANUAL

- A. Perform tests based on manufacturer and industry standards for each systems device, cable, and piece of systems equipment as applicable. Tests shall be performed with manufacturer recommended testing equipment and accessories.
- B. Test procedures shall be developed by the Contractor using manufacturer and industry standards. The test procedures shall describe the test instruments used, conditions of tests, when tests are scheduled and who will perform each test for all devices, cabling, and end-to-end testing of all systems.
- C. Submit for review and approval a Test Procedure Manual for each system to include the data listed below:
  - 1. Test procedures for partial and total systems testing.
  - 2. Systems adjustment schedule to include all systems components that require adjusting.
  - 3. Typical Test Record Forms which will be used for recording test results. Cabling test record forms shall identify each cable consistent with the cabling schedules required.
- D. When factory testing is specified, provide the information listed below:
  - 1. The Design Professional shall have the option of witnessing factory tests. The Contractor shall submit for approval the test procedure and notify the Design Professional a minimum of 15 working days prior to the manufacturer's making the factory test.
  - 2. Submit two (2) copies of certified test reports containing test data to the Design Professional for approval prior to final inspection and not more than 30 days after completion of tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be responsible for additional expenses.

#### 1.9 TEST RECORD MANUAL

- A. Submit a Test Record Manual for each system to include the actual measurement data, as listed below:
  - 1. Approved test procedures and criteria.
  - 2. System adjustment schedule.
  - 3. Test records with actual test results, recorded on approved Test Report Forms.

4. List of test equipment used.
5. List of typical test conditions.
6. Date and time of testing.
7. Name and telephone number of the organization and person who performed the testing.

#### 1.10 SITE TESTS

- A. Include partial, work phase, and end-to-end testing necessary to verify and record on approved Test Record Manual forms the compliance with applicable codes, standards, regulations, manufacturer specifications, and Contract Documents.
- B. At a minimum, the site tests shall include:
  1. Testing of all assemblies.
  2. Testing of individual systems equipment for each function.
  3. Testing of all cabling for shorts, opens, grounds, and visual inspection for physical damage and labeling.
- C. At least three (3) business days prior to scheduled onsite A/V Systems testing with the Design Professional and Owner, the Contractor shall submit the final audio configuration file(s) for review. At the time of this submission, all configuration shall be finalized, tuned for each specific area, and fully tested in accordance with the requirements given in 274116. This includes input and output gain, acoustic echo cancellation, mixing, auto-mixing, routing, level adjustments, logic, filters, and equalization. Approval shall not relieve the Contractor of providing all functionality and meeting all requirements of the Contract Documents.

#### 1.11 SYSTEM ACCEPTANCE

- A. Schedule the FINAL ACCEPTANCE TESTS with the Owner and Design Professional at a mutually agreed time. Contractor shall notify the Owner and Design Professional a minimum of 2 weeks in advance of the intended final acceptance time.
- B. Should any part of a system fail during the acceptance tests to perform according to the Contract Documents, the entire system shall be retested at an Owner-selected time and date.
- C. The Contractor shall correct deficiencies unacceptable to the Owner and Design Professional and provide a complete and functional system.
- D. Record and submit to the Owner the final test results as specified herein.
- E. Acceptance: Systems shall not be accepted by the Owner until deficiencies have been corrected.
- F. Beneficial use of systems by Owner shall not be considered as an acceptance.
- G. Should additional expense occur to the Design Professional due to repeated reviews, such expense shall be reimbursable to the Design Professional from the Contractor. This shall not be construed as a penalty, but as additional project related time because the Contractor's failure to correct the

work properly has made the additional review(s) necessary. In the event of such additional expenses, the Design Professional will furnish evidence of such expenses to the Contractor.

1.12 AS-BUILT DRAWINGS

- A. The Contractor shall keep their on-site blueprints up to date at all times. All wiring shall be marked and indexed for permanent record and submitted with as-builts.
- B. When field work has been completed, and before final inspection, deliver to the Owner's Representative a complete set of prints, marked in colored marker, to show all changes made in the drawings so as to indicate the work as-built. Include dimensions from reference points for any concealed work (junction boxes, etc.) requiring future access.
- C. The Contractor shall provide the Design Professional with the as-built drawings in electronic PDF and AutoCAD or Revit formats. The electronic AutoCAD or Revit format of the as-built drawings shall provide the same information as provided on the complete set of paper and PDF as-built drawings. The AutoCAD or Revit files shall also include individual device information to include manufacturer and model number for each device associated with each device.
- D. The as-built drawings shall be fully detailed and shall generally include at minimum the same level of detail as the shop drawings. Additionally, the as-built drawings shall include the following information:
  - 1. The exact installed location of each system wire, devices, components, etc., including but not limited to: field devices, control rooms, electrical and equipment rooms and equipment, wire management, conduit, racks, enclosures, junction boxes, terminal splice boxes, UPS, and associated electric panels, circuit numbers, wire numbers, and unused spare and extra cables.
  - 2. The exact path taken for all related system wiring and/or conduit.
  - 3. Each sub-system shall be shown in a separate and distinct color. This shall include all devices, outlets, junction boxes, and system wiring for each sub-system.
  - 4. For each terminal junction splice cabinet or junction box a complete listing of the circuits and circuit numbers. In addition, this listing shall include the devices that are connected to these circuits and their exact location. This shall be shown in a chart type form, for each junction or splice location.
- E. The As-Built Drawings shall include all as-built conditions and information pertinent to this project in AutoCAD format.
- F. The As-Built drawings shall be created and produced by the Contractor – the Bid Documents drawings shall not be used as any part of the as-built drawing set.
- G. Submit hardcopy and electronic format documents as detailed in Division 0 and 1 specifications. This shall be done prior to final system acceptance by the Design Professional and the Owner.

1.13 SERVICE AND TECHNICAL ASSISTANCE SCHEDULE

- A. Provide a systems servicing schedule in a 1½" binder and PDF that shall include the information described below:

1. Typical Systems Failures: Information that must be known by Owner's system operating personnel before calling for services. Provide service log for recording all date and time of service calls, type of failure, description of the repairs, time to repair and service person's name and telephone, date, time when the system was returned to normal operation.
2. Service and Technical Assistance personnel and phone numbers schedule. The personnel, department representatives shall be those normally assigned by the contractor / servicing company for the type and size of the systems installed under this project.

#### 1.14 OPERATION AND MAINTENANCE MANUALS

##### A. The Maintenance Manuals shall contain:

1. Testing and Adjusting Flow Charts, and descriptions.
2. Troubleshooting Flow Charts, and descriptions - Provide typical one page flow charts for testing and troubleshooting in a format that is ready for framing.
3. Service and technical assistance schedule - Provide a systems servicing schedule that shall include the information described below:
  - a. Typical System Failures: Information that must be known and entered into the service log by the Owner's system operating personnel before calling for services. Provide service log for recording all date and time of service calls, type of failure, description of the repairs, time to repair and service person's name and telephone, date, time when the system was returned to normal operation.
  - b. Schedule of contractor and manufacturers' authorized service and technical assistance personnel with associated phone numbers and business schedules. The personnel, department representatives shall be those normally assigned by the contractor/system servicing company for the type and size of the systems installed under this project.
4. Spare parts schedule, with recommended spare parts list for the type, size and complexity of the systems provided under this project.
5. Product data.
  - a. System Record Manual shall include as-built / final information and data for the products used for the Project. Structure this manual similar to the Product Data Manual including separate chapters for Spare Parts and Equivalent Products.
6. System As-Built Drawings.

#### 1.15 TRAINING

- A. Provide training of Owner's selected representatives for operation, maintenance, and programming.
- B. Operation and Maintenance, Programming Manuals: Provide a copy of Operation Manuals, Programming Manuals and Maintenance Manuals to each of the participants to the training. Minimum eight (8) hardcopy sets of manuals are required. Provide computer files with the contents of the training manuals.

- C. Training sessions shall contain all information necessary for correct and effective operation, maintenance, testing, adjusting, and programming of each system component.
- D. Effective Training Periods. Preparation, set-up, and testing times shall be included in addition to the minimum training sessions.
- E. See Training Schedule in Table 270510-1 in this specifications section for the quantities and durations of sessions to be provided for each topic.

#### 1.16 TRAINING FOR SYSTEM OPERATION

- A. Relate the contents of the training sessions for operation to the contents of the Operation Manuals. Provide minimum eight (8) hardcopy Operation Manuals for the systems listed. Provide computer files with the contents of the training manuals.
- B. The Operation Manuals shall contain:
  - 1. Sequences of operation shown on actual graphic representation of the signals and controls provided.
  - 2. Operation Flow Charts (OFC) and descriptions - Provide typical one page flow charts for operation and troubleshooting in a format that is ready for framing.
  - 3. List of information the System Operator have to gather and log in the service log, before calling for service or technical assistance.
  - 4. List of contractor and manufacturers authorized service and technical assistance representatives, their telephone numbers and normal business schedule.
- C. In addition to the above manuals, the Installation Contractor shall provide a trained manufacturer's representative during normal business hours to instruct the Owner's designated personnel on the operation and maintenance of the entire system. The following topics shall be included:
  - 1. Overview of the systems operation.
  - 2. Presentations of the user manuals and detailed instructions on how to operate and execute all function of the system.
  - 3. Hands-on practice in the system operation.
  - 4. Maintenance procedures.

#### 1.17 TRAINING FOR PROGRAMMING

- A. Relate the contents of the training sessions for programming to the contents of the Programming Manuals. Provide minimum eight (8) hardcopy Programming Manuals for the systems listed. Provide computer files with the contents of the training manuals.
- B. The Programming Manuals shall include:
  - 1. Control workstations, Graphics User Interfaces, and Control Keypads, typical task-oriented flow charts. As a minimum the following tasks are required: data entry, configuration, review, report generation, diagnostics, start-up.

2. Program troubleshooting flow charts - Provide typical one page flow charts for testing, programming, and troubleshooting in a format that is ready for framing.
3. List of information the system programmer is required to document before service or technical assistance calls.
4. List of contractor and manufacturer authorized service and technical assistance representatives, their telephone numbers and normal business schedule.
5. List of Firmware and Software versions available for the system provided for this Project, description of the various characteristics of the firmware and software in terms of benefits to the end user.
6. System upgrading characteristics and relocation information including hardware implications.

1.18 TRAINING FOR SYSTEM MAINTENANCE

- A. Relate the maintenance training to the contents of the Operation and Maintenance Manuals, described herein. Provide minimum eight (8) hardcopy Maintenance Manuals for the systems listed. Provide computer files with the contents of the training manuals.
- B. The Maintenance Manuals shall contain:
  1. Testing and Adjusting Flow Charts, and descriptions.
  2. Troubleshooting Flow Charts, and descriptions - Provide typical one page flow charts for testing and troubleshooting in a format that is ready for framing.
  3. Service and technical assistance schedule - Provide a system servicing schedule that shall include the information described below:
    - a. Typical System Failures: Information that must be known and entered into the service log by the Owner's system operating personnel before calling for services. Provide service log for recording all date and time of service calls, type of failure, description of the repairs, time to repair and service person's name and telephone, date, time when the system was returned to normal operation.
    - b. Schedule of the Contractor's and the manufacturers' authorized service and technical assistance personnel with associated phone numbers and business schedules. The personnel and department representatives shall be those normally assigned by the contractor/system servicing company for the type and size of the systems installed under this project.
  4. Spare parts schedule, with recommended spare parts list for the type, size and complexity of the system provided under this project.
  5. Product data.
    - a. System Record Manual / Operation & Maintenance Manual shall include as-built / final information and data for the products used for the Project. Structure this manual similar to the Product Data Manual including separate chapters for Spare Parts and Equivalent Products.
  6. System As-Built Drawings.

1.19 TRAINING VIDEO DVDS

- A. Provide Training Video DVDs in standard format. Provide digital video files in AVI format for all training videos. Provide separate video DVDs with all training required for operation, programming and maintenance of the systems provided under this contract. The training DVDs shall closely follow the content of the training manuals and the on-site training provided. The video training DVDs shall include titling for each operation, programming and maintenance function. Contractor shall ensure that the video recording equipment is synchronized with all project video sources to avoid shadowing and blanking. At the minimum the training video DVDs shall include the information listed below:
1. The Operation video training DVDs shall include all relevant information for operation of all devices provided. The training shall address interpretation of each signal, required operator actions, the sequence of operator actions, all operator follow up and reporting functions shown on graphical user's guide. Provide detailed demonstration of back-up, restoral procedures, emergency operations including power failures, partial and system failures. Refer to Operator Manual specifications, for additional requirements.
  2. The Programming video training DVDs shall include all relevant information for programming of all devices provided. Provide interpretation of error messages and required debugging. Refer to Programming Manual specifications for additional requirements.
  3. The Maintenance video training DVDs shall include testing, diagnostics, interpretation of results and inspection procedures. Provide detailed preventive maintenance procedures demonstrated through visual inspection, testing, cleaning, replacement and reconditioning of parts.

1.20 SOFTWARE AND ARTWORK SAFEKEEPING

- A. At minimum two (2) weeks before Acceptance, the Contractor shall deliver to the Owner, under signature, the following software and original artwork:
1. All standard operating/application software source code used for this project.
  2. Original software and software descriptions and manuals for all A/V Systems.
  3. All custom operating/application software source code and required compilers specifically developed for this project.
  4. Complete copies of all compiled and un-compiled files, code, software, and modules used.
  5. All diagnostic software source code and reporting facilities.
  6. Complete software database for all A/V systems software and databases on removable hard disk or compact disks as applicable as of date of acceptance by the Contracting Officer. All software shall be labeled with manufacturer's name and software version number. All custom software shall be appropriately labeled. All software shall be accompanied by a user manual.
  7. All original artwork for graphic control panels in AutoCAD/BIM/Revit file format or other open-standards-based, well-known file format.
  8. User instruction manuals for all software and systems.

1.21 SPECIAL TOOLS, EQUIPMENT AND MATERIALS

- A. Deliver to the Owners representative all special tools, equipment, and materials necessary to maintain the systems provided under this Contract. A list of all special tools, equipment and materials associated with each systems shall be submitted to the Owner minimum 2 weeks prior to final acceptance test.
- B. All electrical work documented on drawings or required under the specifications shall be provided in its entirety.
- C. Electrical specifications appearing in other Divisions of this set of Contract Documents shall be considered a part of this specification and shall be enforced as if fully described within these special requirements. The specifications for materials and installation of electrical/electronic components specified within Division 27 shall supersede those of any other section.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 ADJUSTING OF SYSTEMS

- A. All systems components shall be adjusted for optimum performance under the local conditions particular to the project. The Contractor shall be responsible at no charge to the Owner to readjust all systems to the Owner's satisfaction after the equipment has been in service for 90 days.

3.2 SYSTEMS CERTIFICATION

- A. The Contractor shall be responsible for Total Quality Control Management for all work provided. Provide certification of the following in regards to the systems:
  - 1. The Contractor shall inspect, test, and adjust systems as required to meet the operational, performance, and reliability requirements. When system is operating as specified, the Contractor shall schedule and organize joint testing with Design Professional and Owner.
  - 2. The Contractor shall provide joint testing and certification with the Owner designated inspection firm, Local Authorities Having Jurisdiction, and Design Professional.
  - 3. The Contractor shall submit complete Certifications and test results. Refer to Certification Forms included with the Contract Documents.
  - 4. The Contractor shall provide a separate certification for each system.
  - 5. The systems certification shall attest that the systems provided meet the operational criteria established by the Contract Documents and the requirement of codes, standards and regulations applicable for the systems using the systems.
  - 6. A manufacturer's representative shall be present during each systems testing and certification.

- B. After all final tests and adjustments have been completed and approved by the Design Professional/Owner, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for the equipment furnished by the Contractor. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Manufacturer's representative shall conduct training on specialized electronic systems as described herein.
- C. The Contractor shall submit separate recommended INSPECTION, TESTING AND PREVENTIVE MAINTENANCE PROCEDURES for each system.

### 3.3 SYSTEMS ACCEPTANCE

- A. Schedule the FINAL ACCEPTANCE TESTS with the Owner and Design Professional at a mutually agreed time. Contractor shall notify the Owner and Design Professional a minimum of two (2) weeks in advance of the intended final acceptance time.
- B. Should any part of a system fail during the acceptance tests to perform according to the Contract Documents the entire system shall be retested at an Owner selected time and date.
- C. Correct deficiencies unacceptable to the Owner and provide a complete and functional system.
- D. Record and submit to the Owner the final test results as specified herein.
- E. Acceptance: Systems will not be accepted by the Owner until deficiencies have been corrected.
- F. Beneficial use of systems by Owner will not be considered as an acceptance.
- G. Should additional expense occur to the Design Professional due to repeated reviews, such expense shall be reimbursable to the Design Professional from the Contractor. This shall not be construed as a penalty but as additional project related time because the Contractor's failure to correct the work properly has made the additional review(s) necessary. In the event of such additional expenses, the Design Professional will furnish evidence of such expenses to the Contractor.

### 3.4 WARRANTY

- A. Refer to Section 270500 for Warranty requirements.

### 3.5 SYSTEMS MAINTENANCE AND SERVICE

- A. Refer to Section 270500 for Maintenance and Service requirements.

### 3.6 CORRECTION OF WORK, FINAL PAYMENT, AND WARRANTY

- A. Refer to Section 270500 for requirements.

### 3.7 TABLE 280510-1 - TRAINING SCHEDULE

- A. The Contractor in coordination with the system manufacturers shall provide Training for Operation, Programming and Maintenance for each system specified in Division 27 as shown on the Training Schedule included in this Section. The system training and training manuals shall be specifically for the systems provided under this project.

B. Refer to training schedule below:

Specification Sections	Description	Sessions	Time Each (Hours)	Comments/ Reference Section
271000	STRUCTURED CABLE SYSTEMS			
	• Operation	2	1	
	• Programming	N/A	N/A	
	• Maintenance	2	1	
274116, 274117, 274118	A/V SYSTEMS			
	• Operation	6	1	
	• Programming	2	2	
	• Maintenance	2	2	

3.8 TABLE 270510-2 - SUBMITTAL REGISTER

A. The Contractor shall submit coordinated drawings, manuals, and test results for each system specified under Division 27. Refer to individual system specification sections for additional details and requirements. All submittals shall be stamped-approved by Contractor, signed, and dated prior to review. Unsigned materials shall be returned for such approval.

B. Refer to the Submittal Register on the next page:

Description	Submit For			Submit As Part Of		Comments / Reference Sections
	Review	Approval by Owner &/or Design Professional	Records	Shop Dwgs & Product Data	As-Built Dwgs & O&M Manuals	
Special Systems Qualifications	X	X	X	X		270500
Performance Bonds	X		X	X		270500
Product Data	X	X	X	X	X	Item 1.4
Shop Drawings	X	X	X	X		Item 1.5
Test Procedures Manual	X	X		X	X	Item 1.8
Test Record Manual	X	X	X	X	X	Item 1.9
As-Built Drawings	X		X		X	Item 1.12
Systems Service & Technical Assistance Schedule	X		X		X	Item 1.13
Operation and Maintenance Manuals	X		X		X	Item 1.14
System Training DVDs	X		X		X	Item 1.19
Software, Source Code and Art Work	X		X		X	Item 1.20
Systems Certification	X	X	X		X	Item 3.2
Guarantee Certificate	X		X		X	Next page

3.9 SYSTEMS CERTIFICATION FORMS

- A. Refer to the sample Systems Certification Forms on the next page:

Company Letterhead:

Date: \_\_\_\_\_

### Structured Cabling System

We \_\_\_\_\_ certify that the Structured Cabling System provided under contract \_\_\_\_\_ is fully operational and meets all requirements of applicable codes, standards, regulations and contract documents as indicated on this certification test report.

*Notes:*

1. All responses shall be based on inspection, testing and adjusting performed on the date shown above for this certification.
2. The company issuing the certification shall clearly identify/indicate all differences and exceptions from features, functions shown on Contract Documents.
3. A copy of this certification and Inspection, Testing, Adjusting and Maintenance requirements shall be maintained at the Owner's file and Contractor's file.

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### Part I General

1.1 Project Name: \_\_\_\_\_ Location: \_\_\_\_\_  
Project Numbers: \_\_\_\_\_

1.2 Applicable Codes, Standards and Regulations (List):

1.3 Manufacturer Instructions (List):

1.4 Applicable Contract Documents (List Drawings, Specs, Addendums, Bulletins):

1.5 Test Reports Are Located: \_\_\_\_\_

The final/acceptance tests were witnessed through:

Authority having jurisdiction, represented by: \_\_\_\_\_

Owner, represented by: \_\_\_\_\_

1.6 As-Built/Record Drawings are located: \_\_\_\_\_

1.7 Operating and Maintenance Manuals, Product Data are located: \_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Company Letterhead:

Date: \_\_\_\_\_

### Audio, Video, and A/V Control Systems

We \_\_\_\_\_ certify that the Structured Cabling System provided under contract \_\_\_\_\_ is fully operational and meets all requirements of applicable codes, standards, regulations and contract documents as indicated on this certification test report.

*Notes:*

1. All responses shall be based on inspection, testing and adjusting performed on the date shown above for this certification.
2. The company issuing the certification shall clearly identify/indicate all differences and exceptions from features, functions shown on Contract Documents.
3. A copy of this certification and Inspection, Testing, Adjusting and Maintenance requirements shall be maintained at the Owner's file and Contractor's file.

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### Part I General

1.1 Project Name: \_\_\_\_\_ Location: \_\_\_\_\_  
Project Numbers: \_\_\_\_\_

1.2 Applicable Codes, Standards and Regulations (List):

1.3 Manufacturer Instructions (List):

1.4 Applicable Contract Documents (List Drawings, Specs, Addendums, Bulletins):

1.5 Test Reports Are Located: \_\_\_\_\_

The final/acceptance tests were witnessed through:

Authority having jurisdiction, represented by: \_\_\_\_\_

Owner, represented by: \_\_\_\_\_

1.6 As-Built/Record Drawings are located: \_\_\_\_\_

1.7 Operating and Maintenance Manuals, Product Data are located: \_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

END OF SECTION 270510

**SECTION 271000 – STRUCTURED CABLING SYSTEM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Specification.
- B. Refer to all Contract Drawings and Specifications listed in Section 270500 for additional requirements.
- C. Refer to Divisions 26 and 28 Specifications for coordination information.

1.2 COORDINATION

- A. Work shall be coordinated with all trades having related work on site including but not limited to general, building, structural, civil, site, landscape, mechanical, electrical, fire alarm, fire protection, and HVAC.

1.3 ADDITIONAL REFERENCED STANDARDS

- A. ANSI/TIA-568-D-0 (Including all current addenda), Generic Telecommunications Cabling for Customer Premises
- B. ANSI/TIA-568-1-D (Including all current addenda), Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA-568-2-D (Including all current addenda), Balanced Twisted-Pair Telecommunications Cabling and Components Standard
- D. ANSI/TIA-568-3-D (Including all current addenda), Optical Fiber Cabling Components Standard
- E. ANSI/BICSI N1-2019, Standard for Installing Commercial Telecommunications Cabling
- F. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (latest edition)
- G. Building Industry Consulting Services International (BICSI) Information Transport Systems Installation Manual (latest edition)
- H. ANSI/TIA-569-E, Commercial Building Standard for Telecommunications Pathways and Spaces
- I. ANSI/TIA-526-14, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- J. ANSI/TIA-526-7, Optical Power Loss Measurements of Installed Single-Mode Fiber Cable Plant

- K. ANSI/TIA-606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- L. ANSI-J-STD-607-D, Generic Telecommunications Bonding and Grounding for Customer Premises
- M. IEEE 802.3, Ethernet and all associated applicable standards

#### 1.4 SUMMARY

- A. Refer to the Contract Drawings for additional requirements.
- B. The Structured Cabling System shall be a complete and fully functional network cabling system supporting all computer, telephone, and networked based applications required by the Owner.
- C. The Structured Cabling System work shall include providing the following:
  - 1. New equipment racks, cable trays, and accessories in the new Demarc.
  - 2. Category-6A and fiber optic patch panels in the new Demarc.
  - 3. New equipment racks, cable trays, and accessories in each new MDF.
  - 4. Category-6A and fiber optic patch panels in each new MDF.
  - 5. New equipment racks, cable trays, and accessories in each new IDF.
  - 6. Category-6A and fiber optic patch panels in each IDF.
  - 7. New equipment racks, cable trays, and accessories in the new Data Center.
  - 8. Category-6A and fiber optic patch panels in the Data Center.
  - 9. Fiber optic, Cat-6A, and Cat-5e cabling from the Demarc to each MDF as shown on the Contract Drawings. Refer to T-300 series drawings.
  - 10. Fiber optic, Cat-6A, and Cat-5e cabling from the each MDF to each IDF in the same building as shown on the Contract Drawings. Refer to T-300 series drawings.
  - 11. Category-6A cabling from each IDF to each multi-service tele/data communications outlets.
  - 12. Labeling of all cables, patch panels, racks, and enclosures.
  - 13. J-hooks, cable tray, and conduits as required to run new Category-6A cabling concealed above finished ceilings as required for each outlet. If there are locations where it will not be possible to run all cabling concealed, coordinate with the Electrical Contractor for pathways. Submit to the Design Professional, Architect, and Owner for approval prior to running exposed.
  - 14. J-hooks, cable tray, conduits, fabric type innerduct, and HDPE innerduct as required to run new fiber optic cabling concealed above finished ceilings as required for each termination location. If there are locations where it will not be possible to run all cabling concealed, coordinate with the Electrical Contractor for pathways. Submit to the Design Professional, Architect, and Owner for approval prior to running exposed.
  - 15. Wireless Access Point cabling and outlets. Wireless Access Points (WAP's) shall be provided by the Owner.

16. All patch panels, cables, patch cables, connectors, cable management, and accessories for a complete and fully functional system as intended and described by the Contract Drawings and these Specifications.
  - D. The Structured Cabling System shall be designed to support 1 Gbps Ethernet at the access layer with 10 Gbps Ethernet uplinks between the IDF's and the MDF. All cables shall be tested and certified to their maximum rated standards.
  - E. All data cables shall be run in conduit or concealed in finished wall or above finished ceilings. Coordinate with the Electrical Contractor.
  - F. Coordinate installation of electric power to each equipment rack with the Electrical Contractor. Uninterruptible power supplies (UPS's) shall be provided by the Contractor – coordinate with the Division 26 Electrical Contractor.
  - G. Coordinate equipment rack layout, cable management, rack accessories, and equipment racking with HVAC Contractor for proper cooling, ventilation, and airflow.
  - H. Provide testing, certification, start-up, and close-out.
  - I. The Contractor shall submit shop drawings, product data, test procedures, test reports, and construction and system schedules to provide a complete and fully functional system acceptable to the Design Professional and the Owner. Structured Cabling System documentation shall include the path of each individual cable and associated tables indicating all connections from field outlet through switch port. Refer to section 270510 for additional requirements.
  - J. Complete installation for the Structured Cabling System shall include coordination with other trades to provide all necessary outlets, cabling, patch panels, and patch cabling for all IP networked systems.
- 1.5 INSTALLATION
- A. Outlet Types: Refer to Contract Drawings for outlet type definition and corresponding details.
  - B. Outlet Distribution: Refer to Contract Drawings for outlet distribution. Coordinate exact outlet placement with other trades and field conditions.
  - C. Cabling and patch panels shall be organized according to both the outlet location and the intended function of the outlet. Refer to T-200, T-300, and T-400 series drawings for additional details. All outlets, cabling, and patch panels shall be labeled accordingly.
  - D. Patch panels and switches shall be racked and cabled together according to their intended function to maintain organization and reduce patch cable lengths. Refer to T300 series drawings and coordinate with the Owner for approved rack layouts.
  - E. Provide equipment racks, cable tray, and accessories in the Demarc, Data Center, MDF's, and IDF's as shown on the drawings and as required for an organized, efficient, workmanlike installation that meets all manufacturers' requirements and recommendations.
  - F. All cable ties shall be hook and loop strap type – zip ties shall not be accepted on any Cat-6a cabling.

- G. Provide 10-foot service loop for all cables at the equipment room end to allow for equipment rack or patch panel movement without needing to re-terminate cables. Neatly bundle the cables and secure above finished ceiling with D-rings, j-hooks, or other code-compliant and appropriately rated means.

## PART 2 - PRODUCTS

### 2.1 NETWORK ACCESS LAYER SWITCHES

- A. All Access Layer switches shall be provided by the Owner. The Contractor shall coordinate with the Owner regarding installation and powering on all switches.

### 2.2 NETWORK CORE SWITCHES

- A. All Core Layer switches shall be provided by the Owner. The Contractor shall coordinate with the Owner regarding installation and powering on all switches.

### 2.3 NETWORK SECURITY DEVICES

- A. All network security devices shall be provided by the Owner.

### 2.4 TELECOMMUNICATIONS EQUIPMENT

- A. All telecommunications equipment shall be provided by the Owner. The Contractor shall coordinate with the Owner regarding installation and powering on all switches. The Contractor shall not be responsible for installation of tele/data telephones or tele/data computers.

### 2.5 NETWORK SINGLE MODE FIBER OPTIC CABLE

- A. Provide single mode fiber optic cabling as shown on the Contract Drawings.
- B. All cable shall be continuous between the terminals with no splicing.
- C. The loss of performance of each fiber-terminated connector shall be measured and recorded. The loss shall not exceed the sum of cable and connector losses specified by cable and connector manufacturers +10%.
- D. Cable shall be listed for riser or plenum use as required. Cables passing between floors without passing through a plenum space shall be at minimum listed for riser use. Cables passing through a plenum space shall be listed for plenum use.
- E. Network single mode fiber optic cabling shall be OS2 single mode fiber.
- F. Single mode fiber optic cable shall conform to the following specifications as a minimum:
  - 1. 9/125 microns: Stranded tight buffer.
  - 2. Fiber Type: Single mode
  - 3. Operating Wavelengths: 1310 nm and 1550 nm.
  - 4. UL/c UL Type OFNP/OFN FT6.
  - 5. Typical Attenuation: Suitable for the application.

6. Bandwidth: 1Gbps, 10Gbps, and 40Gbps.
  7. Operating Temperature: -40°C to +65°C.
  8. Connectors: LC
- G. Cable shall be compatible with 1000 Base-LX, 10G Base-LR, and 40G Base-LR4 network standards as required by distance and bandwidth.
- H. FIC shall be configured for termination of the fibers to ensure a reliable, easy to maintain network. FIC shall be unit equipped for cable quantities as described in Contract Documents plus 100% spare capacity.
- I. Fiber optic cabling shall have overall interlocking aluminum armor so as not to require HDPE innerducts or dedicated conduits for physical protection. Provide fabric type innerduct in all conduits to subdivide the conduits.
- J. End-to-end fiber optic structured cabling system shall be approved by the manufacturers for use together.
- K. Manufacturers: Subject to compliance with requirements, provide products by Hubbell, CommScope, Corning, Panduit, Sincor, Optical Cable Corporation, Belden, Mohawk/CDT, or approved equal.

## 2.6 NETWORK MULTIMODE FIBER OPTIC CABLE

- A. Provide multimode fiber optic cabling for fiber optic connections as shown on the Contract Drawings.
- B. All cable shall be continuous between the terminals with no splicing.
- C. The loss of performance of each fiber-terminated connector shall be measured and recorded. The loss shall not exceed the sum of cable and connector losses specified by cable and connector manufacturers +10%.
- D. Cable shall be listed for riser or plenum use as required. Cables passing between floors without passing through a plenum space shall be at minimum listed for riser use. Cables passing through a plenum space shall be listed for plenum use.
- E. Network multimode fiber optic cabling shall be OM4 multimode fiber.
- F. Multimode fiber optic cable shall conform to the following specifications as a minimum:
1. 50/125 microns: Stranded tight buffer.
  2. Fiber Type: Multimode, Graded Index.
  3. Operating Wavelengths: 850 nm and 1300 nm.
  4. UL/c UL Type OFNP/OFN FT6.
  5. Typical Attenuation: Suitable for the application.
  6. Bandwidth: 1Gbps, 10Gbps, and 40Gbps.

7. Operating Temperature: -40°C to +65°C.
8. Connectors: LC
  
- G. Cable shall be compatible with 1000 Base-SX, 1000 Base-LX, 10G Base-SR, 10G Base-LRM, and 40G Base-SR4 network standards as required by distance and bandwidth.
- H. Fiber optic cabling shall have overall interlocking aluminum armor so as not to require HDPE innerducts or dedicated conduits for physical protection. Provide fabric type innerduct in all conduits to subdivide the conduits.
- I. End-to-end fiber optic structured cabling system shall be approved by the manufacturers for use together.
- J. Manufacturers: Subject to compliance with requirements, provide products by Hubbell, CommScope, Corning, Panduit, Siecor, Optical Cable Corporation, Belden, Mohawk/CDT, or approved equal.

## 2.7 FABRIC INNERDUCT

- A. Provide fabric type innerduct as intended by the Contract Drawings and where new fiber optic cabling is installed in conduit.
- B. Fabric innerduct shall be white in color.
- C. Fabric innerduct shall be listed for riser and/or plenum use as required. Fabric innerducts passing between floors without passing through a plenum space shall be at minimum listed for riser use. Fabric innerducts passing through a plenum space shall be listed for plenum use.
- D. Fabric innerduct shall be pre-lubricated and pre-installed with pull tapes for ease of use.
- E. Fabric innerduct shall be available in sizes for conduits ranging from 1" to 4". Provide overall fabric innerduct size according to the size of the conduit in which it will be installed.
- F. Individual cells shall be sized to support cabling with outer diameter of up to 1". Provide fabric innerduct configurations with the maximum quantity of 1" cells that fit in each conduit.
- G. Provide a minimum of two (2) spare fabric innerduct cells for all fiber optic cabling paths. Refer to the Contract Drawings for additional requirements in specific locations.
- H. Manufacturers: Subject to compliance with requirements, provide products by Maxcell Premise, Milliken, Dura-Line, or approved equal.

## 2.8 CATEGORY-6A DISTRIBUTION/HORIZONTAL CABLE

- A. Provide Category-6A distribution cable for connecting all field devices and outlets to the nearest associated IDF and as shown on Contract Drawings.
- B. Cable shall be Category-6A rated, unshielded twisted pair (UTP) cabling.
- C. Cable shall support minimum 1 Gbps and 10 Gbps data communications in compliance with 1000BASE-T and 10GBASE-T standards.

- D. All Category-6A distribution cables specific to data outlets and devices shall have a BLUE colored jacket.
- E. All Category-6A distribution cables specific to voice outlets and devices shall have a YELLOW colored jacket.
- F. All Category-6A distribution cables specific to wireless access point outlets shall have an ORANGE colored jacket.
- G. All Category-6A distribution cables specific to Security devices, including cameras and access control panels, shall have a GREEN colored jacket. Refer to Division 28 for additional details and coordinate with Division 28 Contractor.
- H. All Category-6A distribution cables specific to Audio/Video (A/V) devices shall have a PURPLE colored jacket. Refer to 'T' series drawings and Division 27 A/V specifications for additional details. Coordinate with the Division 27 A/V Contractor.
- I. Cable shall meet or exceed the most current ANSI/EIA/TIA 568 Category-6A standards and shall pass certification testing using the associated approved test limits.
- J. Cable shall be listed for riser or plenum use as required. Cables passing between floors without passing through a plenum space shall be at minimum listed for riser use. Cables passing through a plenum space shall be listed for plenum use.
- K. Manufacturers: Subject to compliance with requirements, provide products by Hubbell NextSpeed, CommScope, Mohawk, Belden, Panduit, Berk-Tek, or approved equal.
- L. All Category-6A cabling shall be as manufactured by the same manufacturer as the Category-6A patch panels and patch cables manufacturer, or the Category-6A cabling manufacturer shall have a mutual agreement with the Category-6A patch panel manufacturer for fully compatible and warranted structured cabling systems.

## 2.9 CATEGORY-6A PATCH PANELS

- A. Provide Category-6A rated patch panels for a complete system as described by the Contract Drawings and Specifications.
- B. Patch panels shall have mounting tabs for mounting on standard 19" rack.
- C. Patch panels shall be available in minimum 24 through 48 port configurations.
- D. Each patch panel port shall have a dedicated label area for computer-generated labeling of each port.
- E. Manufacturers: Subject to compliance with requirements, provide products by Hubbell, Panduit, CommScope, Leviton, Siemon, Ortronics, Berk-Tek, or approved equal.
- F. Patch panels shall be as manufactured by the same manufacturer as the Category-6A distribution cable, or the patch panel manufacturer shall have a mutual agreement with the Category-6A distribution cable manufacturer for fully compatible and warranted structured cabling systems.

2.10 CATEGORY-6A SURGE SUPPRESSORS

- A. Provide Category-6A surge suppressors in the associated equipment room for all Category-6A cables to devices and cables which are outside the building. This includes but is not limited to devices and outlets on the exterior site, exterior in the Plaza, and exterior on the penthouse and roof levels.
- B. Surge suppressors shall meet or exceed each of the following minimum requirements:
  - 1. Category-6A 10-Gigabit Ethernet compatible.
  - 2. Compatible with 802.3af and 803.3at Power over Ethernet (PoE) and PoE+ for powering end devices from a PoE or PoE+ network switch.
  - 3. Minimum 12-port 19" rack mount configuration.
  - 4. Protection for all four pairs of each cable.
  - 5. 75V clamping voltage.
  - 6. 3000w power dissipation per pair
- C. Coordinate with the Division 26 Electrical Contractor to provide grounding as required for each surge suppressor unit. Refer to the manufacturer's installation manuals and recommendations.
- D. Provide Category-6A surge suppressors as manufactured by Ditek model DTK-RM12POE or approved equal.

2.11 CATEGORY-6A PATCH CABLES

- A. Provide patch cables for all necessary patching in all equipment rooms.
- B. Patch cable jacket colors shall match the corresponding Category-6A distribution cable jacket color.
- C. Patch cables shall be provided from the same manufacturer as the Category-6A distribution cable and be fully compatible so as to qualify for the manufacturer's maximum cabling warranty.
- D. Provide patch cable lengths as required for a neat, organized, workmanlike installation according to the patching and port assignments required by the Owner.
  - 1. For each patch panel termination in the IDF, provide one (1) 7-foot patch cable matching the jacket color of the associated distribution/horizontal cabling.
  - 2. For each tele/data field outlet jack, provide one (1) 10-foot patch cable matching the jacket color of the associated distribution/horizontal cabling.
  - 3. For each WAP location which is provided with a WAP enclosure, provide one (1) minimum 3-foot patch cable matching the jacket color of the associated distribution/horizontal cabling, or longer length as required to reach from the outlet location to the WAP location.

2.12 FIBER OPTIC PATCH PANELS

- A. Provide Fiber Optic Patch Panels as required for a complete system as described by the Contract Drawings and Specifications.

- B. All fiber connections between communications equipment shall be terminated on Fiber Optic Patch Panels and patched to the equipment using Fiber Optic Patch Cables.
- C. Fiber connections on Fiber Optic Patch Panels shall be LC.
- D. Signal losses due to all terminations and patch panels shall be taken into account for calculation of signal power / optical power budget. Fiber optic signals shall maintain the manufacturers' required power levels from end to end.
- E. Provide modular fiber optic patch panels sized to support at least the quantity of fibers to be provided plus 100% spare.
- F. All connectors shall be rated appropriately to support at minimum 1Gbps, 10Gbps, and 40Gbps Ethernet network communications.
- G. All fiber optic patch panels shall be as manufactured by the same manufacturer as the fiber optic distribution cable, or the patch panel manufacturer shall have a mutual agreement with the fiber optic distribution cable manufacturer for full compatibility to be provided with the manufacturer's maximum warranty.
- H. Provide rack mounted fiber optic patch panels, modules, and accessories.
- I. Manufacturer: Subject to compliance with requirements, provide products by Leviton 5R1UL series, Hubbell, CommScope, Corning, Panduit, Siecor, Optical Cable Corporation, Belden, Mohawk/CDT, or approved equal.
- J. The end-to-end fiber optic structured cabling system shall be approved by the manufacturers for use together.

#### 2.13 FIBER OPTIC PATCH CABLES

- A. Provide fiber optic patch cables as required for a complete system as described by the Contract Drawings and Specifications.
- B. All fiber optic patch cables shall be fully compatible with the fiber optic cabling so as to provide the manufacturer's maximum warranty.
- C. Fiber optic patch cables shall be duplex cables with fiber optic connectors according to the patch panel and equipment connector types. Coordinate equipment connector types with the Owner.
- D. Provide patch cable lengths as required for a neat, organized, workmanlike installation according to the patching and port assignments required by the Owner.
- E. The end-to-end fiber optic structured cabling system shall be approved by the manufacturers for use together.
- F. Manufacturer: Subject to compliance with requirements, provide products by Hubbell, CommScope, Corning, Leviton, Panduit, Siecor, Optical Cable Corporation, Belden, Mohawk/CDT, or approved equal.

2.14 TELE/DATA COMMUNICATIONS TERMINATION OUTLETS AND FACEPLATES

- A. Provide modular 1-gang or 2-gang outlets at all communications outlet locations as indicated on the Contract Drawings. Provide proper faceplates to support required services at the locations indicated.
- B. Outlets shall utilize modular “snap-in” type communications connector design.
- C. Provide RJ45-type Category-6A rated modular jacks for all network terminations. Jacks shall be the same color as their associated wiring.
- D. All outlets shall follow TIA/EIA 568-B configuration standard.
- E. Faceplates shall allow for up to six (6) modular RJ45 or RJ11 jacks.
- F. Modular faceplates shall allow for mixing RJ45, and F-type communications connectors on the same faceplate.
- G. All faceplates shall have label fields. The Contractor shall coordinate the faceplate material and color with the Owner, Electrical Contractor, and Architect. Electrical and communications faceplates must match. Coordinate outlet labeling with the Owner.
- H. Provide faceplates and modular “snap-in” tele/data communications connectors from the same manufacturer. Faceplates and connectors shall be as manufactured by the same manufacturer as the Category-6A distribution cable, or the faceplates and connectors manufacturer shall have a mutual agreement with the Category-6A distribution cable manufacturer for fully compatible and warranted structured cabling systems.’
- I. Manufacturers: Subject to compliance with requirements, provide products by Hubbell, Panduit, Leviton, Siemon, Ortronics, or approved equal.

2.15 VOICE RISER CABLE SYSTEM

- A. Provide minimum Category-5e F/UTP riser cabling as shown on the Contract Drawings.
- B. Cabling shall be minimum 25-pair as shown on the Contract Drawings.
- C. Cable jacket shall be at minimum rated for riser use. If cabling is routed to pass through any plenum areas, then cabling rated for plenum use is required.
- D. Provide minimum 25-pair wall-mounted 66-blocks for termination and cross-connects as shown on the Contract Drawings.
- E. Manufacturers: Subject to compliance with requirements, provide products by Hubbell, CommScope, Mohawk, Belden, Leviton, Panduit, Berk-Tek, or approved equal.

2.16 VOICE PATCH PANELS

- A. Provide voice grade patch panels for a complete system as described by the Contract Drawings and Specifications.
- B. Patch panels shall have mounting tabs for mounting on standard 19” rack.

- C. Patch panels shall be available in minimum 24 through 48 port configurations.
- D. Minimum 8P4C “RJ-45” jacks for compatibility with 2-pair analog voice.
- E. 25-pair RJ-21X connector for connection to wall-mounted 66-blocks.
- F. Each patch panel port shall have a dedicated label area for computer-generated labeling of each port.
- G. Manufacturers: Subject to compliance with requirements, provide products by Leviton 49012-J24, Hubbell, Panduit, CommScope, Siemon, Ortronics, Berk-Tek, or approved equal.
- H. Voice patch panels shall be as manufactured by the same manufacturer as the Category-5e 25-pair riser cable, or the patch panel manufacturer shall have a mutual agreement with the Category-5e 25-pair riser cable manufacturer for fully compatible and warranted structured cabling systems.

## 2.17 EQUIPMENT RACKS

- A. Provide equipment racks as shown on the Contract Drawings. Refer to the T series floor plans for rack locations. Refer to T-200 series, T-300 series, and T-400 series drawings for additional details and requirements.
- B. Refer to the Contract Drawing symbol sheet T001 for definitions of the subscripts used to identify particular rack types and sizes on the floor plans. The definition of size or type of a particular rack in a particular location shall not remove the Contractor’s responsibility to coordinate each rack’s type and size with the requirements of each rack’s location and the equipment to be mounted in each rack. If the Contractor finds that a rack size or type definition does not appear to fit with field conditions, the Contractor shall submit a request for information (RFI).
- C. All fixed racks shall be placed in rooms to allow code-required access to front and rear. Rolling and swing racks shall be placed in rooms to allow code-required access to the front of the racks and shall roll or swing out to provide access to the rear - ensure clearance for the rolling or swinging motions.
- D. Coordinate with the Division 26 Electrical Contractor to provide UPS’s and power strips as shown on the Contract Drawings and as required to provide power for the powered network equipment that will be provided by the Owner.
- E. Fixed floor mounted racks shall be bolted to the floor. Wall mounted racks shall be bolted to the wall - coordinate to provide blocking and supports as needed.
- F. Cables shall enter racks from the wire management system above and shall follow guidelines of EIA/TIA 569 Pathways.
- G. New floor mounted 4-post equipment racks for Tele/Data, A/V, and Security equipment in the new Demarc, Data Center, MDF’s, and IDF’s shall have the following features:
  - 1. Mounting rails for standard 19” equipment.

2. At minimum 23.5” depth with 29.5” usable depth using adjustable rails to accommodate typical servers, network switches, patch panels, uninterruptible power supplies (UPS’s), and related equipment and hardware.
  3. At minimum 45U of usable equipment mounting height. Coordinate with the ceiling heights, cable tray, and the work of other trades for each location.
  4. Wireways and horizontal and vertical wire management features to allow for proper workmanlike routing, bundling, securing, and dressing of all cables. Provide 6” wide by 12” deep double-sided external vertical cable management and covers.
  5. Two (2) 10-outlet “0U” vertical power strips for equipment connection with 50% spare.
  6. Provide screws and cage nuts as required for mounting equipment to the equipment rack rails. Provide fifty (50) sets per equipment rack.
  7. Manufacturers: Subject to compliance with requirements, provide products by Chatsworth Products model 15253-703, Middle Atlantic, Winsted, Great Lakes, Hubbell, or approved equal.
- H. New floor mounted 2-post open frame equipment racks for Tele/Data, A/V, and Security equipment in the new Demarc, Data Center, MDF’s, and IDF’s shall have the following features:
1. Mounting rails for standard 19” equipment.
  2. Rated for and with hardware to accommodate typical patch panels, cable management, access layer network switches, and related equipment and hardware.
  3. At minimum 45U of usable equipment mounting height. Coordinate with the ceiling heights, cable tray, and the work of other trades for each location.
  4. Wireways and horizontal and vertical wire management features to allow for proper workmanlike routing, bundling, securing, and dressing of all cables. Provide 6” wide by 12” deep double-sided external vertical cable management and covers.
  5. Two (2) 10-outlet “0U” vertical power strips for equipment connection with 50% spare.
  6. Provide screws and cage nuts as required for mounting equipment to the equipment rack rails. Provide fifty (50) sets per equipment rack.
  7. Manufacturers: Subject to compliance with requirements, provide products by Chatsworth Products model 46353-703, Middle Atlantic, Winsted, Great Lakes, Hubbell, or approved equal.
- I. New wall mounted swing-out equipment racks for Tele/Data, A/V, and Security equipment in the new **Recording Room 1247 and the new Security Room 2014** shall have the following features:
1. Mounting rails for standard 19” equipment.
  2. At minimum 30” depth with 28” usable depth to accommodate typical servers, network switches, patch panels, uninterruptible power supplies (UPS’s), and related equipment and hardware.
  3. At minimum 40U of usable equipment mounting height. Coordinate with the ceiling heights, cable tray, and the work of other trades for each location.
  4. Provide key-locking front door and cabinet hinge to prevent unauthorized access.

5. Wireways and horizontal and vertical wire management features to allow for proper workmanlike routing, bundling, securing, and dressing of all cables. Provide accessories and cable dressing to permit the rack to swing out to its full extent without risking damage to the cabling or connections.
6. Two (2) 10-outlet "0U" vertical power strips for equipment connection with 50% spare.
7. Provide thermostatically-controlled intake and/or exhaust air fans for the rack to ensure ventilation airflow to maintain acceptable operating temperatures for the equipment inside. Provide filters to remove dust and other particulate from the intake air.
8. Provide screws and cage nuts as required for mounting equipment to the equipment rack rails. Provide fifty (50) sets per equipment rack.
9. Manufacturers: Subject to compliance with requirements, provide products by Chatsworth Products model 13493-772, Middle Atlantic, Winsted, Great Lakes, Hubbell, or approved equal.

2.18 CABLE TRAY

- A. Provide ladder-type cable tray as shown on the Contract Drawings and as required for a fully functional, workmanlike structured cabling system installation.
- B. Cable tray shall be a minimum of 24" wide with 12" rung spacing, as shown on the Contract Drawings.
- C. Cable tray shall be suspended from the structural ceiling or mounted to the wall. Provide appropriate mounting hardware and all accessories as required to properly support the cable tray, all cabling to be provided, plus 150% spare cabling capacity.
- D. Provide ladder sections, joints, bends, tees, and all accessories as required for a complete and continuous cable tray system.
- E. All edges shall be rounded and all surfaces shall be smoothed to prevent damage to cabling.
- F. Provide cable management accessories including but not limited to waterfalls and radial horizontal corners to maintain minimum cable bend radii and all other cabling manufacturers' requirements.
- G. Cable tray shall be rated and listed to satisfy all grounding and bonding requirements. This may be accomplished by the construction of the cable tray itself or may be provided through appropriately rated and listed grounding lugs and straps to join together adjacent cable tray sections.
- H. Manufacturer: Subject to compliance with requirements, provide products by Chatsworth Products model series 10250-724, Wiremaid, Cooper B-Line, Eaton, or approved equal.

2.19 RE-ENTERABLE FIRE PENETRATIONS FOR COMMUNICATIONS CABLING

- A. Fire rated cable pathway devices shall be used in fire-rated construction for all low-voltage communications cabling penetration, and as shown on the Construction Drawings.
- B. Penetration devices shall meet all of the following at a minimum:
  1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.

2. Be tested for the surrounding construction and cable types involved.
  3. Have UL Systems permitting cable loads from; “Zero to 100% Visual Fill.” This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
  4. Be “Maintenance-Free”, having a corresponding Evaluation Services Report from a Nationally Recognized Third Party Laboratory. Maintenance-Free is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
    - a. Opening or closing of doors.
    - b. Spinning rings to open or close fabric liner.
    - c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
    - d. Evaluation Services Report (ESR) from an accredited Nationally Recognized Third-party Laboratory certifying compliance with this definition of “Maintenance-Free” and all relevant codes and standards.
  5. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
    - a. When installed individually in floors, devices shall pass through core-drilled or preformed opening utilizing tested floor plates.
    - b. When multiple units are ganged in floors, devices shall be anchored by means of a tested grid.
    - c. When installed individually in walls, devices shall pass through core drilled opening utilizing tested wall plates or integrated flanges.
    - d. When multiple units are ganged in walls, devices shall be anchored by means of a tested adjustable gang bracket.
    - e. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.
  6. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
  7. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
- C. Manufacturer: Subject to compliance with requirements, provide products by STI, Hilti, 3M, or approved equal.

### PART 3 - EXECUTION

#### 3.1 INSPECTION AND PREPARATION WORK

- A. The Contractor shall examine the conditions under which the system installation is to be performed and notify the Design Professional in writing of unsatisfactory conditions. Do not

proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.

- B. Prior to the start of installation, meet at the project site with all trades involved to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout, wall layout, and other work which penetrates or is supported throughout the space of the building. All work shall be flush/semi-flush and workmanlike in all finished areas.

### 3.2 INSTALLATION

- A. Contractor shall be certified by the manufacturers prior to installation of communications equipment and cabling. Technicians must have successfully completed all necessary training for certification.
- B. All cables shall be installed to the EIA/TIA-568B wiring scheme.
- C. Install materials and equipment in accordance with manufacturer's printed instructions to comply with governing regulations and industry standards applicable to the work and as shown on approved shop drawings.
- D. Installation shall be in accordance with EIA/TIA-569 "Pathways".
- E. Arrange and mount all equipment and materials in a manner acceptable to the Owner and Design Professional.
- F. Minimal allowable bend radius of all conduits and raceways shall be 6". LB type conduit outlet bodies shall not be permitted.

### 3.3 CONFIGURATION

- A. Programming and configuration of all active Tele/Data and IT equipment shall be performed by the Owner. Coordinate cabling requirements with the Owner according to the requirements of their configuration.

### 3.4 TESTING

- A. After installation, all cables shall be tested with a minimum Level III tester with accuracy of 100dB at 500MHz. Testing shall be done in compliance with TSB-67 standards. Tester shall test for Category-6A Link requirements. Test shall provide a Pass/Fail result and all measured results on each link. The results shall be provided in both hard copy and electronic PDF format.
  - 1. Testing and certification for Category-6A cables shall follow the requirements of TIA-568-B.2 for Category-6A cabling and connecting hardware. Test limits and results shall include:
    - a. Wire Map
    - b. Length
    - c. Insertion Loss (IL)
    - d. Near End Crosstalk (NEXT)
    - e. Far End Crosstalk (FEXT)

- f. Equal Level Far End Crosstalk (ELFEXT)
  - g. Return Loss
  - h. Propagation Delay (PD)
  - i. Delay Skew (DS)
  - j. Longitudinal Conversion Loss (LCL)
  - k. Longitudinal Conversion Transmission Loss (LCTL)
2. Any cable not passing testing and certification requirements shall be repaired or replaced and tested again until it meets or exceeds requirements. This shall be completed by the Contractor at no additional cost to the Owner.
- B. OTDR fiber testing shall also be provided in compliance with the EIA/TIA-568 requirements with maximum loss of 0.75dB per connector, or as required for the associated Ethernet standard, whichever is more strict. Pass/Fail results shall be provided with each fiber run along with length, loss at both 850 and 1300nm or 1310nm and 1550nm in both directions, margin over standards, and time and date stamp on each fiber run.
- C. Fiber test results shall be provided in the same electronic format as the copper test results.

### 3.5 WARRANTY

- A. The contractor shall provide a 20-year warranty for the structured cabling system covering cable, connectivity, and labor. Warranty shall include applications assurance including but not limited to Gigabit Ethernet and 10-Gigabit Ethernet.

### 3.6 COMPLETION OF WORK

- A. The Contractor shall be required to verify the following:
- 1. Pull ropes are provided and maintained in all conduits. Pull tapes are provided and maintained in all spare innerducts.
  - 2. All fastenings are properly secured.
  - 3. Clear and unobstructed infrastructure pathways are provided which in no way limits the ability to install additional cabling in a safe, secure, and workman-like manner.
  - 4. All equipment has been cleaned of construction debris and dust and left in a "like-new" condition.

END OF SECTION 271000

## **SECTION 274116 – AUDIO SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Specification.
- B. Refer to all Contract Drawings and Specifications listed in Section 270500 for additional requirements.
- C. Refer to Divisions 26 and 28 Specifications for coordination information.

#### 1.2 COORDINATION

- A. Work shall be coordinated with all trades having related work on site including but not limited to general, building, structural, civil, site, landscape, mechanical, electrical, fire alarm, fire protection, and HVAC.

#### 1.3 SYSTEM DESCRIPTION

- A. A/V Systems shall be provided as shown on “T” series Contract Drawings and these Specifications.
- B. The Audio Systems shall be configured to support multiple microphone and line level inputs while providing multiple output mixes for general room sound reproduction, conferencing, and assistive listening system (ALS).
- C. The audio systems include, but are not limited to, the following:
  - 1. Audio presentation through amplifiers and ceiling-mounted speakers. The system shall include audio processing and volume control equipment for powering the ceiling speakers from microphone, line, blu-ray, CD, auxiliary, and computer inputs where shown.
  - 2. Remote control of audio systems from locations shown on the Contract Drawings.
- D. The audio systems shall be integrated into the new audio/video and controls systems to form a unified A/V package in each room as shown.
  - 1. All audio system components in each room that are controllable shall be integrated into the new touch screen control system in the same room.

#### 1.4 SYSTEM OPERATION

- A. The user shall interface to the A/V System via touch screen control panels as shown. Refer to Section 274118 for additional details.

1.5 DESCRIPTION OF WORK

- A. The Work includes, but is not necessarily limited to, providing all equipment, labor, materials and technical services for the audio system as follows and as shown on the Contract Drawings. Refer to sections 274117 and 274118 for additional work to be provided.
1. Typical Large Conference Room
    - a. Provide new tabletop-mounted array microphones as shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
    - b. Provide new digital audio matrix mixing and processing software to mix and process all room audio. Software shall be installed on the web conferencing computer in each room.
    - c. A discrete audio amplifier is not required for this room type – refer to ceiling speaker requirements below.
    - d. Provide new ceiling-mounted, PoE-powered, self-amplified, networked ceiling speakers as shown on the Contract Drawings. Provide integration with new digital audio matrix mixing and processing software.
    - e. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
    - f. Provide integration of all audio input/output signals into the digital audio processing and matrix mixing system.
    - g. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
    - h. Provide integration with the new web conferencing systems.
    - i. Provide integration for connection of in-room A/V equipment with web conferencing soft codecs on Owner-provided devices (“Bring Your Own Meeting”).
    - j. Mount all new audio equipment in the new in-wall A/V storage boxes behind the wall-mounted video monitors. Mount all new audio field devices as required and as shown.
    - k. Provide new audio cabling and audio network cabling.
    - l. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
    - m. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.

- n. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.
2. Typical Medium Conference Room
- a. Provide new integral microphone in tabletop-mounted conferencing console as shown on the Contract Drawings. Provide expansion pod microphone as shown.
  - b. Dedicated digital audio matrix mixing and processing software is not required for this room type – all audio mixing, processing, and acoustic echo cancellation (AEC) shall be managed by the web conferencing software and the tabletop-mounted conferencing console.
  - c. A discrete audio amplifier is not required for this room type – refer to tabletop speaker requirements below.
  - d. Provide audio amplification through the integral speaker in the new tabletop-mounted conferencing console as shown on the Contract Drawings. Provide integration with new digital audio matrix mixing and processing software.
  - e. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
  - f. Provide integration of all audio input/output signals into the digital audio processing and matrix mixing system.
  - g. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
  - h. Provide integration with the new web conferencing systems.
  - i. Provide integration for connection of in-room A/V equipment with web conferencing soft codecs on Owner-provided devices (“Bring Your Own Meeting”).
  - j. Mount all new audio equipment in the new in-wall A/V storage boxes behind the wall-mounted video monitors. Mount all new audio field devices as required and as shown.
  - k. Provide new audio cabling and audio network cabling.
  - l. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
  - m. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.
  - n. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.
3. Typical Small Meeting Room or Director Office

- a. Provide new integral microphone in tabletop-mounted conferencing console as shown on the Contract Drawings.
- b. Dedicated digital audio matrix mixing and processing software is not required for this room type – all audio mixing, processing, and acoustic echo cancellation (AEC) shall be managed by the web conferencing software and the tabletop-mounted conferencing console.
- c. A discrete audio amplifier is not required for this room type – refer to tabletop speaker requirements below.
- d. Provide audio amplification through the integral speaker in the new tabletop-mounted conferencing console as shown on the Contract Drawings. Provide integration with new digital audio matrix mixing and processing software.
- e. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
- f. Provide integration of all audio input/output signals into the digital audio processing and matrix mixing system.
- g. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
- h. Provide integration with the new web conferencing systems.
- i. Provide integration for connection of in-room A/V equipment with web conferencing soft codecs on Owner-provided devices (“Bring Your Own Meeting”).
- j. Mount all new audio equipment in the new in-wall A/V storage boxes behind the wall-mounted video monitors. Mount all new audio field devices as required and as shown.
- k. Provide new audio cabling and audio network cabling.
- l. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
- m. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.
- n. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.

**4. Typical Training Room – typical for Training Rooms 2312 and 2543 only**

- a. Provide new ceiling-mounted array microphones as shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).

- b. Provide new wireless handheld vocal microphones, lavalier microphones with wireless body packs, and wireless microphone receivers as shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
- c. Provide new digital audio matrix mixing and processing software to mix and process all room audio. Software shall be installed on the web conferencing computer in each room.
- d. Provide new networked audio power amplifiers to power ceiling speakers and provide audio line output to the assistive listening system as shown.
- e. Provide new ceiling-mounted, passive ceiling speakers as shown on the Contract Drawings. Provide integration with the audio power amplifier and new digital audio matrix mixing and processing software.
- f. Provide assistive listening system (ALS) transmitter and receivers as shown. Provide receivers in quantity as required to meet Americans with Disabilities Act (ADA) requirements. For this room, provide two (2) receivers, both of which shall be configurable with headphones and hearing-aid compatible neck loops.
- g. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
- h. Provide integration of all audio input/output signals into the digital audio processing and matrix mixing system.
- i. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
- j. Provide integration with the new web conferencing systems.
- k. Provide integration for connection of in-room A/V equipment with web conferencing soft codecs on Owner-provided devices (“Bring Your Own Meeting”).
- l. Mount all new audio equipment in the new in-wall A/V storage boxes behind the wall-mounted video monitors. Mount all new audio field devices as required and as shown.
- m. Provide new audio cabling and audio network cabling.
- n. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
- o. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.
- p. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.

5. Café A 2222, Café B 2223, Training 2224, and Training 2232

- a. Provide new ceiling-mounted array microphones where shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
- b. Provide new wireless handheld vocal microphones, lavalier microphones with wireless body packs, and wireless microphone receivers where shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
- c. Provide new wired handheld vocal microphones with floor stands and analog audio to networked audio adapters where shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
- d. Provide new digital audio matrix mixing and processing software to mix and process all room audio. Software shall be installed on the web conferencing computer in each room. Provide new centralized digital audio matrix mixing and processing hardware to mix and process audio when any two (2) or more of the rooms are combined.
- e. Provide new networked audio power amplifiers to power ceiling speakers and provide audio line output to the assistive listening system as shown. The amplifier shall be a centralized unit powering the ceiling speakers in each of the four (4) rooms.
- f. Provide new ceiling-mounted, passive ceiling speakers as shown on the Contract Drawings. Provide integration with the audio power amplifier and new digital audio matrix mixing and processing software.
- g. Provide assistive listening system (ALS) transmitter and receivers where shown. Provide receivers in quantity as required to meet Americans with Disabilities Act (ADA) requirements. For these Training Rooms, provide two (2) receivers each, all of which shall be configurable with headphones and hearing-aid compatible neck loops.
- h. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
- i. Provide integration of all audio input/output signals into the digital audio processing and matrix mixing system. Provide integration for any two (2) or more of these rooms to be able to be combined by making the appropriate selections on the touch screen control panels. All features and functions of each individual room shall be usable when in combined mode, and any one (1) room shall be able to be the primary location when in combined mode.
- j. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
- k. Provide integration with the new web conferencing systems.

- l. Provide integration for connection of in-room A/V equipment with web conferencing soft codecs on Owner-provided devices (“Bring Your Own Meeting”).
- m. Mount all new audio equipment in the new in-wall A/V storage boxes behind the wall-mounted video monitors. Mount all new audio field devices as required and as shown.
- n. Provide new audio cabling and audio network cabling.
- o. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
- p. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.
- q. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.

**6. Café 1110**

- a. Provide new wired handheld vocal microphone with floor stand. Provide integration with the networked audio power amplifier for audio mixing and processing.
- b. Dedicated digital audio matrix mixing and processing software is not required for this room type – all audio mixing and processing shall be provided as an integral feature of the audio power amplifier.
- c. Provide new networked audio mixing power amplifiers to power ceiling speakers. Amplifier shall also accept and mix audio from the wired handheld vocal microphone. Amplifier shall also accept networked audio streams from the **Commissioners Meeting Room 1240** for overflow viewing – refer to the requirements for the Commissioners Meeting Room for additional details.
- d. Provide new ceiling-mounted, passive ceiling speakers as shown on the Contract Drawings. Provide integration with the audio power amplifier.
- e. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
- f. Provide integration of all audio input/output signals into the networked audio mixing power amplifier.
- g. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
- h. Mount all new audio equipment behind the wall-mounted video monitors. Mount all new audio field devices as required and as shown.
- i. Provide new audio cabling and audio network cabling.

- j. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
  - k. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.
  - l. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.
7. Typical Lobby
- a. Provide integration between the digital signage players and the wall mounted monitors for playing any audio which may be required as part of the digital signage. Coordinate with the Owner for digital signage content which will be created and managed by the Owner.

**8. Waiting Room 2110**

- a. Provide new wired handheld vocal microphone with floor stand. Provide integration with the networked audio power amplifier for audio mixing and processing.
- b. Dedicated digital audio matrix mixing and processing software is not required for this room type – all audio mixing and processing shall be provided as an integral feature of the audio power amplifier.
- c. Provide new networked audio mixing power amplifier to power ceiling speakers. Amplifier shall also accept and mix audio from the wired handheld vocal microphone.
- d. Provide new ceiling-mounted, passive ceiling speakers as shown on the Contract Drawings. Provide integration with the audio power amplifier.
- e. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
- f. Provide integration of all audio input/output signals into the networked audio mixing power amplifier.
- g. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
- h. Mount the audio power amplifier in the nearest IDF. Mount all new audio field devices as required and as shown.
- i. Provide new audio cabling and audio network cabling.
- j. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.

- k. Optimize and set all audio levels for the room. After the audio processing and levels are optimized for the local conditions, no user-accessible controls are anticipated to be required.
  - l. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.
9. Commissioners Meeting Room
- a. Provide new ceiling-mounted array microphones as shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
  - b. Provide new shock-mounted gooseneck microphones and analog audio to networked audio adapters as shown on the Contract Drawings. Provide integration with the digital audio processing and matrix mixing system as needed to meet requirements for audio mixing, processing, and acoustic echo cancellation (AEC).
  - c. Provide new digital audio matrix mixing and processing hardware to mix and process all room audio.
  - d. Provide new networked audio power amplifier to power ceiling speakers as shown.
  - e. Provide new ceiling-mounted, passive ceiling speakers as shown on the Contract Drawings. Provide integration with the audio power amplifier and new digital audio matrix mixing and processing hardware.
  - f. Provide assistive listening system (ALS) modulator, emitters, and receivers as shown. Provide receivers in quantity as required to meet Americans with Disabilities Act (ADA) requirements. For this room, provide minimum six (6) receivers with headphones, two (2) of which shall be configurable with headphones and hearing-aid compatible neck loops.
  - g. Provide input/output outlets and plates for audio. Refer to other Division 27 specifications sections for coordination with outlets and plates for other systems.
  - h. Provide integration of all audio input/output signals into the digital audio processing and matrix mixing system.
  - i. Provide integration of all new video systems devices to send, receive, and process audio streams as needed to meet requirements for audio mixing and processing.
  - j. Provide integration with the new web conferencing system.
  - k. Mount all new audio equipment in the new equipment rack in **Recording Room 1247**. Mount all new audio field devices as required and as shown.
  - l. Provide new audio cabling and audio network cabling.

- m. Provide integration of the new networked audio systems. Coordinate with the Owner for network switch ports, Power over Ethernet (PoE and PoE+), IP addresses, virtual local area networks (VLANs), quality of service (QoS), and multicast requirements.
- n. Provide integration with the audio system in **Café 1110** for overflow viewing of proceedings in the Commissioners Meeting Room. Refer to the requirements for Café 1110 for additional details.
- o. Provide control of the audio system equipment power, settings, and levels through integration to the new touch screen control system. Optimize and set all audio levels for the room after integration into the control system. Refer to section 274118 for additional requirements.
- p. Provide all other equipment and features as shown on Contract Drawings and as required for complete and fully functional systems.

#### 1.6 RELATED WORK

- A. In addition to work described above, the Work Shall include, but not necessarily be limited to, the following:
  - 1. Certain rigging of equipment and materials as specified for this Contract.
  - 11. Assemble equipment furnished disassembled.
  - 12. Testing and energizing as specified.
  - 13. Cleaning as specified for this Contract.
  - 14. Equipment identification as specified.
  - 15. Furnishing and installation of all low voltage wires and cables into existing conduit and box system.
  - 16. Miscellaneous steel and hangers required for support of electrical equipment.

#### 1.7 SUBMITTALS

- A. Refer to Section 270510.

### PART 2 - PRODUCTS

#### 2.1 OVERVIEW

- A. The equipment described herein is intended to provide a reference for the Audio System, and it is to be provided as shown on the Contract Drawings.

- B. Certain equipment described may not be applicable to all methods of implementation. All devices required to complete the installation may not be described. It is the responsibility of the contractor to provide a complete working system in coordination with the system vendors.
- C. All system components shall be approved for the function they will perform. Devices that require modification for these applications will not be approved.
- D. The products specified herein were the latest generation at the time of specification and provide the functionality and intent of the system requirements. The Contractor shall provide, at the time of product submittal, the manufacturers latest generation of products, hardware and software, with equal or greater functionality.

2.2 DIGITAL AUDIO PROCESSING AND MATRIX MIXING SOFTWARE – TYPICAL LARGE CONFERENCE ROOMS AND TYPICAL TRAINING ROOMS

- A. The Contractor shall provide all audio distribution equipment, control interface modules, power supplies, wiring, relays, etc., whether listed herein or not, to provide perfectly operational audio processing, matrix mixing and web conferencing systems with no glitches, bugs, or impediments which would otherwise detract from proper system operation. The Contractor shall be informed through thorough investigation of manufacturer recommendations and requirements and shall meet all audio distribution requirements as required by the Design Professional and Owner.
- B. Provide Digital Audio Processing and Matrix Mixing software with at minimum the following features, or as required to support the audio devices and associated requirements, whichever is greater:
  - 1. Dante network support for at minimum eight (8) microphone inputs, eight (8) auxiliary inputs, and eight (8) outputs. Provide licensing as required for additional Dante channels as required to meet the required channel counts in each room.
  - 2. Fully compatible with all microphones, audio input devices, and audio output devices in each room.
  - 3. The software shall be fully compatible with the web conferencing computers and designed by the manufacturers to be installed on the web conferencing computer. The combined package shall be a listed approved package by the web conferencing provider.
  - 4. DSP processing including input gain, automatic gain control (AGC), acoustic echo cancellation (AEC), noise reduction, auto-mixing, equalization and filters, meters, delays, output gain, and all other features and functions required to achieve the design intent as documented by the Contract Documents.
  - 5. Minimum eight (8) simultaneous channels of AEC, or greater as required to provide AEC processing for each individual microphone input for each room.
  - 6. USB interface for integration with in-room A/V devices and Bring-Your-Own-Meeting (BYOM) devices.

7. Fully compatible with the A/V Control System.
- C. The Digital Audio Processor shall be capable of accepting all system audio inputs as represented by the Contract Drawings and as required for a complete and fully functional system.
  - D. The Digital Audio Processor shall be capable of providing all system audio outputs as represented by the Contract Drawings and as required for a complete and fully functional system, including but not limited to the following:
    1. Dante audio feed for Dante ceiling speakers where shown.
    2. Dante audio feed for Dante networked amplifiers to drive passive ceiling speakers where shown.
    3. Audio for ALS where shown.
  - E. The Digital Audio Processor matrix mixing shall be configured to provide the following functions:
    1. All stereo materials shall be combined for single channel reproduction.
    2. The user shall be able to adjust the system through the touchscreen provided in each room. Requiring user adjustment via the physical front panel of the device shall not be acceptable.
    3. The Contractor shall coordinate with the Owner and provide all operation configuration required for the typical types of proceedings to be held in each room. Each room shall include a default preset for all levels. User-configurable functions shall be controlled via the touchscreen control panels.
  - F. The Digital Audio Processing and Matrix Mixing Software shall include all system software and licenses required to program and adjust the system and shall be fully compatible with the A/V Control System (AVCS) for control of all audio features and functionalities.
  - G. The Digital Audio Processing and Matrix Mixing Software shall be as manufactured by Shure IntelliMix Room or approved equal. Provide licenses as required to support all required inputs and outputs.
  - H. The Contractor shall be permitted to submit a substitution request for an alternate product which is hardware-based and/or which uses a different network audio protocol, but in that case the Contractor shall bear all responsibility to provide all required components and licenses and prove that all required performance requirements will be met by the substituted product. Additionally, the Contractor shall provide any and all associated modifications to other devices and equipment as may become necessary due to the substitution. Finally, all A/V systems components used for web conferencing shall be listed as approved packages by the web conferencing providers, so a change to one component might require a change to one or more other components as well.

**2.3 DIGITAL AUDIO PROCESSING AND MATRIX MIXING HARDWARE – COMMISSIONERS MEETING ROOM AND CAFÉ A 2222 / CAFÉ B 2223 / TRAINING 2234 / TRAINING 2332**

- A. The Contractor shall provide all audio distribution equipment, control interface modules, power supplies, wiring, relays, etc., whether listed herein or not, to provide a perfectly operational courtroom audio processing, matrix mixing and audio conferencing system with no glitches, bugs, or impediments which would otherwise detract from proper system operation. The Contractor shall inform himself through thorough investigation of manufacturer and meet all audio distribution requirements as required by the Design Professional and Owner.
- B. Provide Digital Audio Processing and Matrix Mixing software with at minimum the following features, or as required to support the audio devices and associated requirements, whichever is greater:
1. Dante network support for up to at least (32) inputs and (16) outputs. Provide licensing as required for additional Dante channels as required to meet the required channel counts in each room.
  2. Ethernet connection for programming and control.
  3. Internal DSP processing.
  4. 4 channels of general purpose input/output (GPIO).
  5. USB and RS-232 control interface.
  6. 12 balanced mic or line level inputs.
  7. 8 balanced mic or line level outputs.
  8. RJ-45 connector to integrate voice over internet protocol (VoIP) systems. The Court's existing telephone system is by Cisco.
  9. Fully compatible with all microphones, audio input devices, and audio output devices in each room.
  10. The system shall be fully compatible for integration with the web conferencing computers. The combined package shall be a listed approved package by the web conferencing provider.
  11. DSP processing including input gain, automatic gain control (AGC), acoustic echo cancellation (AEC), noise reduction, auto-mixing, equalization and filters, meters, delays, output gain, and all other features and functions required to achieve the design intent as documented by the Contract Documents.
  12. Minimum (12) simultaneous channels of AEC, or greater as required to provide AEC processing for each individual microphone input for each room.

13. USB interface for integration with in-room A/V devices and Bring-Your-Own-Meeting (BYOM) devices.
  14. Fully compatible with the A/V Control System.
- C. The Digital Audio Processor shall be capable of accepting all system audio inputs as represented by the Contract Drawings and as required for a complete and fully functional system.
- D. The Digital Audio Processor shall be capable of providing all system audio outputs as represented by the Contract Drawings and as required for a complete and fully functional system, including but not limited to the following:
1. Dante audio feed for Dante networked amplifiers to drive passive ceiling speakers where shown.
  2. Dante audio feeds for overflow viewing where shown.
  3. Dante audio feeds for combining two (2) or more individual rooms into a combined system where shown.
  4. Audio for ALS where shown.
- E. The Digital Audio Processor matrix mixing shall be configured to provide the following functions:
1. All stereo materials shall be combined for single channel reproduction.
  2. The user shall be able to adjust the system through the touchscreen provided in each room. Requiring user adjustment via the physical front panel of the device shall not be acceptable.
  3. The Contractor shall coordinate with the Owner and provide all operation configuration required for the typical types of proceedings to be held in each room. Each room shall include a default preset for all levels. User-configurable functions shall be controlled via the touchscreen control panels.
- F. The Digital Audio Processing and Matrix Mixing Hardware shall include all system software and licenses required to program and adjust the system and shall be fully compatible with the A/V Control System (AVCS) for control of all audio features and functionalities.
- G. The Digital Audio Processing and Matrix Mixing Software shall be as manufactured by QSC Q-SYS Core 110f or approved equal. Provide licenses as required to support all required inputs and outputs.
- H. The Contractor shall be permitted to submit a substitution request for an alternate product which is software-based and/or which uses a different network audio protocol, but in that case the Contractor shall bear all responsibility to provide all required components and licenses and prove that all required performance requirements will be met by the substituted product. Additionally, the Contractor shall provide any and all associated modifications to other devices and equipment as

may become necessary due to the substitution. Finally, all A/V systems components used for web conferencing shall be listed as approved packages by the web conferencing providers, so a change to one component might require a change to one or more other components as well.

#### 2.4 NETWORKED AUDIO POWER AMPLIFIERS – TYPICAL TRAINING ROOM

- A. Provide new amplifiers with channel count as required for speaker output circuit shown on Contract Drawings.
- B. Small form factor to be able to mount within the in-wall A/V storage box behind the primary wall mounted video monitor.
- C. Dante networked audio inputs to receive audio from the digital audio processing and matrix mixing software.
- D. The amplifier shall provide a minimum of 300W per channel @ 70-volt or as required by the speakers provided, whichever is greater.
- E. Class D with active power factor correction.
- F. 70-volt compatible system
- G. Fully compatible with the ceiling speakers and the digital audio processing and matrix mixing software.
- H. Audio line output for integration with the assistive listening system (ALS). Integral mixer as required to receive the Dante input and provide a suitable analog audio output for the ALS.
- I. Provide networked audio power amplifiers as manufactured by Extron model NetPA U 2002 SB, or approved equal.

#### 2.5 AUDIO POWER AMPLIFIERS – WAITING ROOM 2110

- A. Provide new amplifiers with channel count as required for speaker output circuit shown on Contract Drawings.
- B. Microphone input for integration with the wired handheld vocal microphone. Fully compatible to support the wired handheld vocal microphone. Integral processor and mixer to process the microphone audio to be suitable for announcements through the ceiling speakers.
- C. Dante networked audio integration shall be optional depending upon the wired handheld vocal microphone that is provided.
- D. Rack mounted.
- E. The amplifier shall provide a minimum of 250W per channel @ 70-volt or as required by the speakers provided, whichever is greater.
- F. Class D with active power factor correction.

- G. 70-volt compatible system.
- H. Fully compatible with the ceiling speakers.
- I. Provide audio power amplifiers as manufactured by Lab Gruppen model D 10:4L or approved equal.

2.6 **NETWORKED AUDIO POWER AMPLIFIERS – CAFÉ 1110**

- A. Provide new amplifiers with channel count as required for speaker output circuit shown on Contract Drawings.
- B. Microphone input for integration with the wired handheld vocal microphone. Fully compatible to support the wired handheld vocal microphone. Integral processor and mixer to process the microphone audio to be suitable for announcements through the ceiling speakers.
- C. Small form factor to be able to mount behind one of the wall mounted video monitors.
- D. Dante networked audio inputs to receive networked audio from Commissioners Meeting Room 1240 digital audio processing and matrix mixing system.
- E. The amplifier shall provide a minimum of 100W per channel @ 70-volt or as required by the speakers provided, whichever is greater.
- F. Class D with active power factor correction.
- G. 70-volt compatible system.
- H. Fully compatible with the ceiling speakers and the digital audio processing and matrix mixing system.
- I. Provide networked audio power amplifiers as manufactured by Extron model NetPA U 1002-70V, or approved equal.

2.7 **AUDIO POWER AMPLIFIERS – COMMISSIONERS MEETING ROOM AND CAFÉ A 2222 / CAFÉ B 2223 / TRAINING 2234 / TRAINING 2332**

- A. Provide new amplifiers with channel count as required for speaker output circuit shown on Contract Drawings.
- B. Rack mounted.
- C. The amplifier shall provide a minimum of 300W per channel @ 70-volt or as required by the speakers provided, whichever is greater.
- D. Class D with active power factor correction.
- E. 70-volt compatible system.

- F. Fully compatible with the ceiling speakers and the digital audio processing and matrix mixing hardware.
- G. Provide audio power amplifiers as manufactured by Crown model DCi 4|300, Lab Gruppen, QSC, or approved equal.

**2.8 NETWORKED POE+ CEILING SPEAKERS – TYPICAL LARGE CONFERENCE ROOMS**

- A. Provide new networked power over Ethernet plus (PoE+) ceiling mounted speakers as shown on the Contract Drawings.
- B. New ceiling speakers shall, at minimum, meet each of the following requirements at minimum:
  - 1. 5.25” full range two-way driver
  - 2. Operating range: 100Hz to 20kHz
  - 3. Powered by PoE+ and self-amplified
  - 4. Maximum output level of at least 98dB at 1m
  - 5. Removable magnetic grille
  - 6. Physically sized to be compatible with the ceiling system. Provided with appropriate acoustic ceiling tile mounting bracket and hardware as shown on the Contract Drawings and as recommended by the manufacturer.
  - 7. Fully compatible with and integrated with the digital audio matrix mixer.
- C. Provide networked PoE+ ceiling speakers as manufactured by Shure MXN5W-C or approved equal.

**2.9 CEILING SPEAKERS – ALL ROOMS REQUIRING CEILING SPEAKERS EXCEPT TYPICAL LARGE CONFERENCE ROOMS**

- A. Provide new ceiling mounted speakers as shown on the Contract Drawings.
- B. New ceiling speakers shall, at minimum, meet each of the following requirements at minimum:
  - 1. 6” full range dual concentric driver
  - 2. Operating range: 80Hz to 15kHz
  - 3. Multiple transformer taps for 70V line systems
  - 4. Sensitivity: minimum 91dB/W at 1m
  - 5. Removable magnetic grille

6. Physically sized to be compatible with the ceiling system. Provided with appropriate acoustic ceiling tile mounting bracket and hardware as shown on the Contract Drawings and as recommended by the manufacturer.

7. Fully compatible with and integrated with the amplifier and digital audio matrix mixer.

C. Provide ceiling mounted speakers as manufactured by Tannoy CMS 603DC BM, JBL Control 26CT, QSC, AtlasIED, or approved equal.

## 2.10 MICROPHONES

### A. Shock Mount Gooseneck Microphones

1. Provide 12” shock mounted gooseneck microphones with integral mute button and LED indicator light as manufactured by Shure MX412S/C, or equal by AKG, Sennheiser, or approved equal.

### B. Wired Handheld Vocal Microphones

1. Provide wired handheld vocal microphone with on/off switch as manufactured by Shure SM58S, or equal by AKG, Sennheiser, or approved equal. Provide adjustable floor stand as manufactured by the microphone manufacturer where indicated.

### C. Microphone Input to Network Audio Adapters

1. Where indicated on the Contract Drawings, provide an adapter to convert from analog microphone audio to Dante networked audio for compatibility with the digital audio processing and matrix mixing systems.

2. The basis of design shown on the Contract Drawings utilizes a Decora mounting style device which can be installed in an outlet backbox and present an XLR-3 microphone audio connection(s). The Contractor shall bear all responsibility for any and all modifications that may be required if an alternate product is submitted for approval for use.

3. The adapters shall be fully compatible with all microphones that will be connected, including but not limited to providing phantom power and input gain where required.

4. Adapters shall be powered by power over ethernet (PoE)

5. Provide microphone input to network audio adapters as manufactured by Extron AXI 22 AT D, or equal by RDL or QSC or approved equal.

### D. Wireless Lavalier Microphone Systems

1. Provide wireless lavalier microphone system including wireless body pack transmitter, lavalier microphone with tie clip, and rechargeable battery as manufactured by Shure ULXD1, WL185, and SB900A or equal by AKG, Sennheiser, or approved equal.

### E. Wireless Handheld Microphone Systems

1. Provide wireless handheld microphone system including wireless handheld transmitter, cardioid capsule, and rechargeable battery as manufactured by Shure ULXD2/SM58 and SB900A, or equal by AKG, Sennheiser, or approved equal.

**F. Wireless Microphone Battery Charging Systems**

1. Provide wireless microphone battery charging systems in quantity as required to charge all wireless microphones simultaneously plus one (1) spare.
2. The wireless microphone battery charging system shall be fully compatible with the wireless microphone batteries and shall be fully approved by the wireless microphone battery manufacturer for charging the batteries.
3. Provide wireless microphone battery charging systems as manufactured by Shure model SBC200-US, or equal by AKG, Sennheiser, or approved equal.

**G. Wireless Microphone Receivers**

1. Provide dual-channel wireless microphone system receiver that is fully compatible with all wireless microphone systems.
2. Wireless microphone receiver shall include Dante networked audio output in order to be compatible and integrated with the associated audio processing and matrix mixing software.
3. Where shown on the Contract Drawings, provide remote antennas, cabling, and amplifiers as required by cabling distance.
4. Wireless microphone receiver system shall be as manufactured by Shure ULXD4D-GV, or equal by AKG, Sennheiser, or approved equal.

**H. Ceiling-Mounted Microphone Arrays**

1. Provide ceiling-mounted microphone array to provide audio pickup throughout the intended areas as intended by the Contract Drawings.
2. The ceiling-mounted microphone array shall meet all of the following requirements at minimum:
  - a. Use multiple tunable microphone elements to focus coverage on the specific room areas where meeting attendees will be present and speaking, while rejecting sound from outside of these intended coverage areas. There shall be sufficient lobes or steerable coverage areas to evenly cover all intended speaking locations within each room. The lobes or steerable coverage areas shall be configurable to be optimized for the local conditions of each room. Each lobe or steerable coverage area shall be continually automatically fine-tuned based on the talkers' exact locations within the room.
  - b. Single-channel and multi-channel audio output using Dante networked audio in order to be compatible with the digital audio processing and matrix mixing systems.

- c. Digital audio signal processing including at minimum acoustic echo cancellation (AEC) for each lobe or steerable coverage area, noise reduction, automatic mixing, and automatic gain control.
  - d. Suitable for use in voice lift applications.
  - e. Powered by power over Ethernet (PoE).
  - f. Fully compatible with the digital audio processing and matrix mixing systems.
  - g. Designed for ceiling-mounting above the intended coverage areas and suitable for the room geometries included in this project. Provide all mounting hardware and accessories as recommended by the manufacturer for mounting the microphone array in the specific ceiling types in this project.
3. Provide ceiling-mounted microphone array as manufactured by Shure MXA910, or equal by Sennheiser, or approved equal.

I. Table Microphone Arrays

1. Provide table-mounted microphone array to provide audio pickup throughout the intended areas as intended by the Contract Drawings.
2. The table-mounted microphone array shall meet all of the following requirements at minimum:
  - a. Use multiple tunable microphone elements to focus coverage on the specific room areas where meeting attendees will be present and speaking, while rejecting sound from outside of these intended coverage areas. There shall be sufficient lobes or steerable coverage areas to evenly cover all intended speaking locations within each room. The lobes or steerable coverage areas shall be configurable to be optimized for the local conditions of each room. Optimize the selection and configuration of the effective polar patterns for the specific arrangements and distances at each location. Effective polar patterns shall include at minimum cardioid, hypercardioid, supercardioid, toroid, omnidirectional, and bidirectional.
  - b. Single-channel and multi-channel audio output using Dante networked audio in order to be compatible with the digital audio processing and matrix mixing systems.
  - c. Digital audio signal processing including at minimum filtering, equalization, automatic mixing, and automatic gain control.
  - d. Suitable for use in voice lift applications.
  - e. Powered by power over Ethernet (PoE).
  - f. Fully compatible with the digital audio processing and matrix mixing systems.
  - g. Designed for mounting on conference room tables and suitable for the room geometries included in this project. Provide all mounting hardware and accessories as recommended by the manufacturer for mounting the microphone array on the specific table types in this project.

3. Provide table-mounted microphone array as manufactured by Shure MXA310, or equal by Sennheiser, or approved equal.

2.11 TABLETOP-MOUNTED TOUCH SCREEN CONTROL CONFERENCING CONSOLE

- A. Provide tabletop-mounted touch screen control conferencing consoles with integral microphone arrays and speaker as shown on the Contract Drawings. The consoles as a whole are specified under Specifications Section 274117. The specifications in this section 274116 cover only the audio functionality – refer to 274117 for additional details and requirements.
- B. The integral microphone array shall meet all of the following requirements at minimum:
  1. Multiple microphone elements for targeting coverage in the intended talker locations while rejecting sound from outside of the intended locations.
  2. 360-degree pickup and minimum 10-foot coverage radius.
  3. Integral mute buttons and bi-color status LED indicators to indicate mute status.
  4. Digital audio processing to provide at minimum: acoustic echo cancellation (AEC), automatic mixing, automatic gain control, and noise reduction.
  5. Capable of expanding audio pickup coverage by integrating with up to two (2) expansion microphone pods. Each expansion pod shall include an integral mute button and status LED indicator. Expansion pods shall be powered by the main console unit. Provide expansion pods where shown on the Contract Drawings.
- C. The integral speaker shall meet all of the following requirements at minimum:
  1. Full range driver with 90Hz to 20kHz frequency response.
  2. Integral 11-watt amplifier.
  3. At minimum 95 dB SPL at 0.5m maximum output.
- D. Tabletop-mounted touch screen control conferencing consoles shall be as manufactured by Crestron UC-MX50-T and UC-MX70-T as shown or approved equal. Refer to Specifications Section 274117 for additional details and requirements.
- E. The Contractor shall be permitted to submit a substitution request for an alternate product which meets all performance requirements, but in that case the Contractor shall bear all responsibility to provide all required components and licenses and prove that all required performance requirements will be met by the substituted product. Additionally, the Contractor shall provide any and all associated modifications to other devices and equipment as may become necessary due to the substitution. Finally, all A/V systems components used for web conferencing shall be listed as approved packages by the web conferencing providers, so a change to one component might require a change to one or more other components as well.

2.12 AUDIO/VIDEO SWITCHING AND DISTRIBUTION EQUIPMENT

- A. Provide audio inputs for audio from the Audio/Video switching equipment. Refer to section 274117 and the Contract Drawings for additional details.

2.13 ASSISTIVE LISTENING FOR ADA COMPLIANCE (ADA-ALS) – TYPICAL TRAINING ROOMS AND CAFÉ A 2222 / CAFÉ B 2223 / TRAINING 2234 / TRAINING 2332

- A. Provide infrared assistive listening system as shown on the Contract Drawings.
- B. New assistive listening system shall, at minimum, meet each of the following requirements:
1. Combined modulator and emitter in one (1) unit.
  2. Minimum one-channel IR transmitter that is fully compatible with the IR receivers.
  3. Transmitting power for all-channel minimum coverage area of 10,000 square feet.
  4. Audio input to receive the room mix audio from the audio processing and matrix mixing system. The Contract Drawings illustrate using the line output on the networked amplifier in the Typical Training Room, or using a Dante to analog audio adapter such as Audinate Dante AVIO in the other rooms. The Contractor shall be permitted to submit a substitution request for approval of an alternate product which uses a Dante input directly into the ALS transmitter.
  5. Provide adapter as manufactured and approved by the ALS system manufacturer to be able to power the transmitter using power over ethernet (PoE).
  6. The transmitter shall be fully compatible with the IR receivers.
  7. Provide minimum two (2) two-channel receivers with headphones. Provide four (4) sets of batteries for each receiver.
  8. Provide minimum two (2) induction neck loops for hearing aid compatibility.
- C. Provide assistive listening system as manufactured by Williams AV model IR SY5, or equal by Listen Technologies or Sennheiser or approved equal.

2.14 ASSISTIVE LISTENING FOR ADA COMPLIANCE (ADA-ALS) – COMMISSIONERS MEETING ROOM

- A. Provide infrared assistive listening system as shown on the Contract Drawings.
- B. New assistive listening system shall, at minimum, meet each of the following requirements:
1. Discrete rack-mounted modulator and wall-mounted emitters as shown on the Contract Drawings.
  2. Minimum one-channel system that is fully compatible with the IR receivers.
  3. Transmitting power for all-channel minimum coverage area of 10,000 square feet.

4. Analog audio input to receive the room mix audio from the audio processing and matrix mixing system.
  5. Provide power supply as required to power the modulator which in turn also powers the emitters.
  6. The transmitter shall be fully compatible with the IR receivers.
  7. Provide minimum six (6) two-channel receivers with headphones. Provide rechargeable batteries and charging cradles to be able to charge all receivers simultaneously.
  8. Provide minimum two (2) induction neck loops for hearing aid compatibility.
- C. Provide assistive listening system as manufactured by Williams AV model IR SY11 plus two (2) additional receivers with charging cradle, or equal by Listen Technologies or Sennheiser or approved equal.

## 2.15 WIRING

- A. Provide all new wiring necessary to connect the new audio/video system input/output outlets to the audio system processing, switching, and distribution equipment. All wiring shall be of the type, size, and quality necessary to maintain the signal characteristics required to meet the overall audio system minimum performance requirements.
- B. The following are minimum quality and standard requirements for audio cabling:
1. Microphone audio cabling shall be: 1 pair, # 22 AWG, twisted, shielded, stranded.
  2. Line level audio cabling shall be: 2 pair, # 22 AWG, twisted, shielded, stranded.
  3. Speaker circuit cabling shall be: 1 pair, # 18 AWG, stranded, or as recommended by the speaker and amplifier manufacturers.
  4. Network cabling shall be Category-6A U/UTP, or as recommended by the networked audio systems manufacturers. Cable jacket shall be PURPLE. Refer to Specifications Section 271000 for additional details and requirements.
- C. The type and characteristics of all wiring shall be confirmed with the audio and audio/video system manufacturers. Where the manufacturers minimum requirements are different from those specified herein, the higher quality cabling shall be provided at no additional cost to the Owner.
- D. Signal levels shall be maintained within the audio system manufacturers specified limits at all interfacing and connection points. Provide distribution amplifiers/line drivers as required to meet distribution requirements.

## PART 3 - EXECUTION

### 3.1 INSPECTION AND PREPARATION WORK

- A. This contractor shall examine the conditions under which the system installation is to be performed and notify the Owner's Representative and Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.
- B. Prior to the start of systems installation, meet at the project site with the Design Professional and all trades involved to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other work which penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

### 3.2 SPECIFIC INSTALLATION REQUIREMENTS

- A. Equipment shall be installed in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered as if part of these Specifications.
- B. If a major deviation from the drawings is indicated by practical considerations, the Contractor shall consult with the Design Professional for resolution, and shall submit shop drawings, showing all deviations in such detail as will clearly indicate the necessity or desirability for the change.
- C. Shielded cables shall maintain shield continuity. Shields shall not be grounded except at the control panel with single point grounding per manufacturers' recommendations.
- D. Unless specifically dimensioned on the drawings, the locations of equipment are approximately correct. The exact location and arrangement shall be determined as the work progresses to conform in the best possible manner with its surroundings. All such locations and arrangements shall be approved by the Design Professional or Owner, as applicable, before installation. Coordinate with other trades to ensure that all equipment is installed in locations that shall not create any undesirable conditions.
- E. The Contractor shall coordinate the placement of all devices in relation to lectern cabinets, tables, desks, structural panels, trims, moldings, etc. Examine Design Professional's detailed drawings and also all drawings, catalog cuts, etc. for special apparatus which must be roughed-in and connected. Coordinate with the Owner and Design Professional. Outlets, apparatus, and related connections which are improperly located through failure to follow the above instructions, shall be subject to correction and/or relocation without extra charges to the Owner.

### 3.3 ADJUSTING, TESTING AND CLEANING

- A. Test Procedures
  - 1. System tests shall be performed based on approved test procedures.
  - 2. Test Procedures shall be developed by the contractor and reviewed by the manufacturers.

3. Prior to requesting substantial completion inspection, the Contractor shall submit the completed test forms indicating that all components have successfully passed testing. Substantial completion testing shall not occur prior to the complete system first passing the Contractor's testing.

**B. Adjusting of Systems**

1. All system components shall be adjusted for optimum performance under the local conditions particular to the project.
2. All audio systems components shall be adjusted and configured for optimum audio quality, including but not limited to all of the following:
  - a. Audio levels - all input and output levels shall be adjusted to achieve optimum and balanced levels across all inputs and outputs. All inputs shall be clearly audible at all outputs. All speakers shall be balanced to provide uniform coverage across the entire intended listening area that does not vary by more than 4dB SPL from loudest to quietest. Measurements of system performance will be made using calibrated ANSI or IEC precision sound level meter set for "slow" meter damping and flat response, 4 feet above the floor (seated ear height) within the system coverage area. All interior finishes and furnishing shall be in place, and system gain shall be adjusted to provide levels of at least 70 dB, or 15 dB above background noise levels, whichever is higher, at the measuring locations for these tests.
  - b. Audio equalization - parametric equalization shall be configured for all inputs and outputs to normalize the levels across all frequency bands. The overall space-average acoustical frequency response criterion, as measured within the coverage area of the system loudspeakers, shall be within  $\pm 3$  dB of a spectrum which is flat from 125 to 2500 Hz and slopes downward thereafter at a rate of 3 dB per octave to 12,500 Hz. Test signals shall be broad-band "pink" noise applied to any system input, measured using 1/3- octave filters centered on ANSI preferred frequencies.
  - c. Feedback suppression - feedback suppression shall be configured for all microphone inputs to prevent feedback and ringing under all normal operating conditions and to enable greater gain before feedback.
3. Adjustments and optimizations to audio shall be made at no additional cost to the Owner until approval from the Owner and Design Professional is issued.
4. The Contractor shall submit detailed test results indicating tests conducted and adjustments configured for each input and output prior to requesting approval.

- C. Refer to sections 270500 and 270510 for additional details and requirements.

**3.4 SYSTEM ACCEPTANCE**

- A. The contractor shall schedule the final acceptance tests with the Owner and Design Professional at a mutually agreed time. The contractor shall notify the Owner and Design Professional a minimum 2 weeks in advance of the intended substantial completion time.

- B. Should any part of a system fail during the acceptance tests to perform according to the contract documents, the entire system shall be re-tested at an Owner approved time.
- C. The contractor shall correct all deficiencies which are unacceptable to the Owner and its representatives and provide a complete and functional system as shown in the contract documents.
- D. The contractor shall record and submit the final test results as specified herein.
- E. Acceptance of the systems shall not be considered by the Owner until all deficiencies have been corrected.
- F. Beneficial use of the systems shall not be considered as acceptance.

3.5 TRAINING

- A. Refer to Sections 270500 and 270510 for requirements.

END OF SECTION 274116

**SECTION 274117 – VIDEO SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Specification.
- B. Refer to all Contract Drawings and Specifications listed in Section 270500 for additional requirements.
- C. Refer to Divisions 26 and 28 Specifications for coordination information.

1.2 SYSTEM DESCRIPTION

- A. Video Systems shall be provided as shown on “T” Contract Drawings and these Specifications.
- B. Video systems include audio that is associated with each video source. Where “Video Systems” are referenced, it shall be understood that the associated audio is included and full integration shall be provided.
- C. The video systems shall be configured to support various video source inputs, while the outputs will be displayed via LED LCD monitors located throughout the rooms, as shown on the Contract Drawings.
- D. The Video System shall include, but not be limited to, the following:
  - 1. Video presentation of video signals through the video monitors mounted throughout the rooms as shown on the Contract Drawings.
  - 2. Video presentation of pre-recorded materials originating from computer sources or other sources using an available input to the system.
  - 3. Video presentation of HDMI sources originating from computers provided by the Owner.
  - 4. Capture of local scenes through local web conferencing system. Input of camera feeds, audio mixer feeds, and video system feeds into the web conferencing computer. Outputs from the web conferencing computer into the room A/V systems.
  - 5. Remote control of all video system components from locations shown on the Contract Drawings. Refer to section 274118 for additional details.

1.3 SYSTEM OPERATION

- A. The user shall interface to the A/V System via touch screen control panels where shown. Refer to Section 274118 for additional details.

1.4 DESCRIPTION OF WORK

- A. The Work includes, but is not necessarily limited to providing, all equipment, labor, materials and technical services as follows and as shown on the Contract Drawings.

1. Typical Large Conference Rooms, Typical Medium Conference Rooms, Typical Small Meeting Rooms and Director Offices, and Typical Training Rooms
  - a. Provide video system transmitters capable of accepting at minimum HDMI video inputs including embedded digital audio.
  - b. Provide video system receivers and USB converters capable of receiving the video streams from the video system transmitters and outputting as USB video that is compatible with the web conferencing computer and software.
  - c. Provide web conferencing cameras for capturing video of in-room participants and scenes for use in web conferences.
  - d. Provide web conferencing computers for running the native web conferencing software from the web conferencing provider(s). Coordinate with the Owner's IT group for configuring the web conferencing accounts.
  - e. Provide "Bring-Your-Own-Meeting" (BYOM) functionality to allow the in-room audio/video assets and functionalities to be used for web conferences which are running on and managed by an Owner-provided laptop or similar.
  - f. Coordinate with the Owner's IT group to provide integration of the new Video System components with the Owner's IP network.
  - g. Provide new wall-mounted video monitors and associated mounts and in-wall storage boxes as shown on the Contract Drawings.
  - h. Provide new Category-6A U/UTP cabling, outlets, and patch cabling for connection to the Owner's IP network and as shown on the Contract Drawings. Provide HDMI video cable as shown on the Contract Drawings. Provide boxes, conduit, and wireway as shown and as needed. Provide new cable management and accessories required to form a complete and workmanlike installation.
  - i. Provide input/output panels for audio, video, and data as shown on the Contract Drawings. Provide outlet plates as shown on the Contract Drawings and as required for a complete and fully functional system.
  - j. Provide touch screen control of all A/V components and equipment. Refer to Section 274118 for additional details and requirements.
  - k. Provide all other equipment and features as shown on Contract Drawings and all other components and accessories for complete and fully functional systems.
2. **Café A 2222, Café B 2223, Training 2224, and Training 2232**
  - a. Provide all of the same video system functionality and components as described above for the typical conference rooms, plus the additional functionality of being able to combine two (2) or more of these four (4) rooms into a combined system for larger events.
  - b. Provide all required components to enable room-combining functionality, including IP network video encoders, IP network video decoders, integration, and control.
  - c. Any of these four (4) rooms shall be capable of acting as the primary room during a combined room event. Provide integration and controls for any room to be a transmitter and any or all rooms to be a receiver.

3. Café 1110

- a. Provide IP network video decoders capable of receiving network video streams from the **Commissioners Meeting Room 1240** for overflow viewing and providing HDMI outputs to wall-mounted LED LCD monitors.
- b. Provide digital signage players for receiving and displaying digital signage, digital directory, and digital cueing content. The content shall be created and managed by the Owner.
- c. Provide configuration and controls for switching the video input selection of the wall-mounted LED LCD monitors based on whether overflow viewing from the Commissioners Meeting Room is activated or not. Activation controls shall be from the Commissioners Meeting Room A/V control system – refer to section 274118 for additional details.
- d. Coordinate with the Owner’s IT group to provide integration of the new Video System components with the Owner’s IP network.
- e. Provide new wall-mounted video monitors and associated mounts and in-wall storage boxes as shown on the Contract Drawings.
- f. Provide new Category-6A U/UTP cabling, outlets, and patch cabling for connection to the Owner’s IP network and as shown on the Contract Drawings. Provide HDMI video cable as shown on the Contract Drawings. Provide boxes, conduit, and wireway as shown and as needed. Provide new cable management and accessories required to form a complete and workmanlike installation.
- g. Provide input/output panels for audio, video, and data as shown on the Contract Drawings. Provide outlet plates as shown on the Contract Drawings and as required for a complete and fully functional system.
- h. Provide all other equipment and features as shown on Contract Drawings and all other components and accessories for complete and fully functional systems.

4. **Waiting Room 2110 and Typical Lobby**

- a. Provide digital signage players for receiving and displaying digital signage, digital directory, and digital cueing content. The content shall be created and managed by the Owner.
- b. Provide configuration and controls for powering on/off the wall-mounted LED LCD monitors based on the schedule configured for the digital signage.
- c. Coordinate with the Owner’s IT group to provide integration of the new Video System components with the Owner’s IP network.
- d. Provide new wall-mounted video monitors and associated mounts as shown on the Contract Drawings.
- e. Provide new Category-6A U/UTP cabling, outlets, and patch cabling for connection to the Owner’s IP network and as shown on the Contract Drawings. Provide HDMI video cable as shown on the Contract Drawings. Provide boxes, conduit, and wireway as shown and as needed. Provide new cable management and accessories required to form a complete and workmanlike installation.

- f. Provide input/output panels for audio, video, and data as shown on the Contract Drawings. Provide outlet plates as shown on the Contract Drawings and as required for a complete and fully functional system.
  - g. Provide all other equipment and features as shown on Contract Drawings and all other components and accessories for complete and fully functional systems.
5. Commissioners Meeting Room
- a. Provide IP network video encoders capable of accepting at minimum HDMI video inputs including embedded digital audio and transmitting across the network.
  - b. Provide IP network video decoders capable of receiving the IP network video streams and outputting HDMI video with embedded audio.
  - c. Provide video system receivers and USB converters capable of receiving the video streams from the video system transmitters and outputting as USB video that is compatible with the web conferencing computer and software.
  - d. Provide web conferencing cameras for capturing video of in-room participants and scenes for use in web conferences and overflow viewing.
  - e. Provide web conferencing computer for running the native web conferencing software from the web conferencing provider(s). Coordinate with the Owner's IT group for configuring the web conferencing accounts.
  - f. Coordinate with the Owner's IT group to provide integration of the new Video System components with the Owner's IP network.
  - g. Provide new wall-mounted video monitors and associated mounts as shown on the Contract Drawings.
  - h. Provide new mobile monitor carts and cart-mounted video monitors as shown on the Contract Drawings.
  - i. Provide integration and control for sending network video streams from the **Commissioners Meeting Room 1240 to Café 1110** for overflow viewing on the wall-mounted LED LCD monitors in Café 1110.
  - j. Provide new Category-6A U/UTP cabling, outlets, and patch cabling for connection to the Owner's IP network and as shown on the Contract Drawings. Provide HDMI video cable as shown on the Contract Drawings. Provide boxes, conduit, and wireway as shown and as needed. Provide new cable management and accessories required to form a complete and workmanlike installation.
  - k. Provide input/output panels for audio, video, and data as shown on the Contract Drawings. Provide outlet plates as shown on the Contract Drawings and as required for a complete and fully functional system.
  - l. Provide touch screen control of all A/V components and equipment. Refer to Section 274118 for additional details and requirements.
  - m. Provide all other equipment and features as shown on Contract Drawings and all other components and accessories for complete and fully functional systems.
6. Network

- a. Coordinate with the Owner's IT group to provide integration of the new network video system components into the Owner's IP network in accordance with the Owner's requirements and the network video device manufacturer's recommendations. This shall include, but not be limited to, virtual local area networks (VLAN's), IP addresses, multicast, quality of service (QoS), and the enabling, disabling, or configuration of all network protocols and services as required to meet the Owner's standard network security requirements.
- a. Provide network configurations for all new network video devices in accordance with the coordination with the Owner's IT group.
- a. Provide full documentation of all network configurations and settings for the Owner's records and management systems.

## 1.5 RELATED WORK

- A. In addition to work described above, the Work Shall include, but not necessarily be limited to, the following:
  - 1. Certain rigging of equipment and materials as specified for this Contract.
  - 2. Assembly of equipment furnished disassembled.
  - 3. Testing and energizing as specified.
  - 4. Cleaning as specified for this Contract.
  - 5. Equipment identification as specified.
  - 6. Furnishing and installation of all low voltage wires and cables into existing conduit and box system.
  - 7. Miscellaneous steel and hangers required for support of electrical equipment.

## 1.6 SUBMITTALS

- A. Refer to Section 270510.

## PART 2 - PRODUCTS

### 2.1 OVERVIEW

- A. The equipment described herein is intended to provide a reference for the Video System, and it is to be provided as shown on the Contract Drawings.
- B. Certain equipment described may not be applicable to all methods of implementation. All devices required to complete the installation may not be described. It is the responsibility of the Contractor to provide a complete working system in coordination with the system vendors.
- C. All system components shall be approved for the function they will perform. Devices that require modification for these applications will not be approved.
- D. The products specified herein were the latest generation at the time of specification and provide the functionality and intent of the system requirements. The Contractor shall provide, at the time

of product submittal, the manufacturers latest generation of products, hardware and software, with equal or greater functionality.

## 2.2 WEB CONFERENCING AUDIO/VIDEO PACKAGES

- A. Provide web conferencing audio/video packages as shown on the Contract Drawings.
- B. The Contract Drawings indicate the system designs using packages of A/V devices and equipment which are pre-packaged to support all required functionality for web conferencing and local presentations. These packages primarily include but are not necessarily limited to: audio and video transmitters, audio and video receivers and USB converters, cameras, web conferencing computers running the native web conferencing software, integration with microphones and speakers, and touch screen control panels.
- C. The Contractor shall be permitted to submit a substitution request(s) for an alternate product(s), but in that case the Contractor shall bear all responsibility to provide all required components and licenses and prove that all required performance requirements will be met by the substituted product. Additionally, the Contractor shall provide any and all associated modifications to other devices and equipment as may become necessary due to the substitution. Finally, all A/V systems components used for web conferencing shall be listed as approved packages by the web conferencing providers, so a change to one component might require a change to one or more other components as well.
- D. Typical Large Conference Room
  - 1. Provide web conferencing A/V packages to include:
    - a. Under-table-mounted A/V transmitter to transmit HDMI input and bidirectional USB audio over Category-6A cabling to the A/V receiver and USB converter. Video shall be minimum 1920x1080 @ 60Hz with 4:4:4 chroma subsampling.
    - b. A/V receiver and USB converter to receive the signals from the under-table-mounted A/V transmitter, convert to USB audio and video, and integrate with the web conferencing computer and web conferencing software.
    - c. Small-form-factor web conferencing computer to run the native web conferencing software from the web conferencing provider(s). The computer shall run Windows 10 and shall be certified for compatibility by the web conferencing provider. Minimum two (2) digital video outputs for driving the wall-mounted monitors as shown on the Contract Drawings. The computer shall be compatible and capable of simultaneously running the Digital Audio Processing and Matrix Mixing software without impediment when all features are enabled – refer to Specifications Section 274116.
    - d. Wall-mounted web conferencing camera with auto-framing to intelligently and automatically zoom and frame the camera view based on the specific locations of all participants in the room.
      - 1) Typical Large Conference Rooms shall be provided with a minimum 20-megapixel camera to enable up to 5x digital zoom. Horizontal field of view shall be minimum 90 degrees to be able to capture the entirety of the participants and scene which are closest to the camera. Using a PoE to USB adapter, the output stream from the camera shall be 1080p @ 30Hz video

which is fully compatible with the web conferencing computer and web conferencing software.

- e. Integration with tabletop-mounted array microphones – refer to Specifications Section 274116.
  - f. Integration with ceiling-mounted audio speakers – refer to Specifications Section 274116.
  - g. Tabletop-mounted touch screen control panel – refer to Specifications Section 274118.
2. Provide web conferencing A/V packages for Typical Large Conference Rooms as manufactured by Crestron UC-CX100-T plus Huddly L1 camera system or approved equal.
- E. Typical Medium Conference Room and Typical Small Meeting Room and Director’s Offices
1. Provide web conferencing A/V packages to include:
    - a. Tabletop-mounted conferencing console including HDMI input, bidirectional USB audio, and integral transmitter for transmitting these signals over Category-6A cabling to the A/V receiver and USB converter.
    - b. A/V receiver and USB converter to receive the signals from the tabletop conferencing console, convert to USB audio and video, and integrate with the web conferencing computer and web conferencing software.
    - c. Small-form-factor web conferencing computer to run the native web conferencing software from the web conferencing provider(s). The computer shall run Windows 10 and shall be certified for compatibility by the web conferencing provider. Minimum one (1) digital video output for driving the wall-mounted monitors as shown on the Contract Drawings.
    - d. Wall-mounted web conferencing camera with auto-framing to intelligently and automatically zoom and frame the camera view based on the specific locations of all participants in the room.
      - 1) Typical Medium Conference Rooms shall be provided with a minimum 20-megapixel camera to enable up to 5x digital zoom. Horizontal field of view shall be minimum 90 degrees to be able to capture the entirety of the participants and scene which are closest to the camera. Using a PoE to USB adapter, the output stream from the camera shall be 1080p @ 30Hz video which is fully compatible with the web conferencing computer and web conferencing software.
      - 2) Typical Small Meeting Rooms and Director’s Offices shall be provided with a minimum 12-megapixel camera supporting digital zoom. Horizontal field of view shall be minimum 120 degrees to be able to capture the entirety of the participants and scene which are closest to the camera. The output stream from the camera shall be 1080p @ 30Hz video which is fully compatible with the web conferencing computer and web conferencing software.
  - e. Integral microphone – refer to Specifications Section 274116.

- f. Integral speaker – refer to Specifications Section 274116.
  - g. Integral touch screen control panel – refer to Specifications Section 274118.
  2. Provide web conferencing A/V packages for Typical Medium Conference Rooms as manufactured by Crestron UC-MX70-T, or approved equal.
  3. Provide web conferencing A/V packages for Typical Small Meeting Rooms and Director’s Offices as manufactured by Crestron model UC-MX50-T or approved equal.
- F. Typical Training Rooms and **Café A 2222 / Café B 2223 / Training 2234 / Training 2332**
1. Provide web conferencing A/V packages to include:
    - a. A/V transmitter to transmit HDMI input and bidirectional USB audio over Category-6A cabling to the A/V receiver and USB converter. Video shall be minimum 1920x1080 @ 60Hz with 4:4:4 chroma subsampling.
    - b. A/V receiver and USB converter to receive the signals from the A/V transmitter, convert to USB audio and video, and integrate with the web conferencing computer and web conferencing software.
    - c. Small-form-factor web conferencing computer to run the native web conferencing software from the web conferencing provider(s). The computer shall run Windows 10 and shall be certified for compatibility by the web conferencing provider. Minimum two (2) digital video outputs for driving the wall-mounted monitors as shown on the Contract Drawings.
    - d. Ceiling-mounted PTZ web conferencing camera. Provide camera with a minimum 1920x1080 resolution with minimum 8x optical zoom. Horizontal field of view shall be minimum 70 degrees to be able to capture the entirety of the presentation area at the front of each room. Provide a video, power, and control extension system to connect the camera with a single Cat-6a cable. The USB output stream from the extension system shall be a minimum 1080p @ 30Hz video which is fully compatible with the web conferencing computer and web conferencing software. Provide the camera manufacturer’s ceiling mounted hardware and accessories.
    - e. Integration with ceiling-mounted array microphones, wireless microphone systems, and wired microphones – refer to Specifications Section 274116.
    - f. Integration with ceiling-mounted audio speakers – refer to Specifications Section 274116.
    - g. Wall-mounted touch screen control panel – refer to Specifications Section 274118.
  2. **Provide web conferencing A/V packages for Typical Training Rooms and Café A 2222 / Café B 2223 / Training 2234 / Training 2332** as manufactured by Crestron UC-CX100-T-WM plus Vaddio RoboSHOT 12E HDBT with OneLINK Bridge Express camera system, or approved equal.

**G. Commissioners Meeting Room 1240**

1. Provide web conferencing A/V packages to include:

- a. A/V transmitter to transmit HDMI input and bidirectional USB audio over Category-6A cabling to the A/V receiver and USB converter. Video shall be minimum 1920x1080 @ 60Hz with 4:4:4 chroma subsampling.
  - b. A/V receiver and USB converter to receive the signals from the A/V transmitter, convert to USB audio and video, and integrate with the web conferencing computer and web conferencing software.
  - c. Small-form-factor web conferencing computer to run the native web conferencing software from the web conferencing provider(s). The computer shall run Windows 10 and shall be certified for compatibility by the web conferencing provider. Minimum one (1) digital video output for input into an IP network video encoder for ultimately displaying on the wall-mounted and cart-mounted monitors as shown on the Contract Drawings.
  - d. Ceiling-mounted networked PTZ web conferencing cameras. Provide cameras with a minimum 1920x1080 resolution and minimum 12x optical zoom. Horizontal field of view shall be minimum 70 degrees to be able to capture wide angle views of the dais, lecterns, and audience area in the room. Cameras shall be native IP networked to provide a video, power, and control over the IP network with a single Cat-6a cable per camera. The cameras shall integrate with the networked digital audio matrix mixer in order to output a minimum 1080p @ 30Hz USB video stream from the selected camera using the USB output of the digital audio matrix mixer. The video shall be fully compatible with the web conferencing computer and web conferencing software. Provide the camera manufacturer's ceiling mounted hardware and accessories.
  - e. Integration with ceiling-mounted array microphones, wireless microphone systems, and wired microphones – refer to Specifications Section 274116.
  - f. Integration with ceiling-mounted audio speakers – refer to Specifications Section 274116.
  - g. Wall-mounted touch screen control panel – refer to Specifications Section 274118.
2. Provide web conferencing A/V package for Commissioners Meeting Room as manufactured by Crestron UC-CX100-T-WM plus four (4) QSC Q-SYS PTZ-IP 12x72 cameras or approved equal.

### 2.3 NETWORK VIDEO SYSTEM

- A. Provide a network video system as shown on the Contract Drawings and with at minimum the following features and capabilities:
  1. Capable of supporting all audio/video inputs and outputs required to meet the system requirements as described by the Contract Drawings and Specifications.
  2. Switching HDMI digital video with fully digital signal routing.
  3. Operating using a gigabit (1Gbps) Ethernet/IP network using standard unshielded category-6a cabling.
  4. Support for all standard resolutions including but not limited to: 3840x2160 (4K) and 1920x1080 progressive @ 30 and 60Hz frame rates, all with 4:4:4 chroma sampling and minimum 24-bit color depth.

5. Encode and transmit locally input HDMI video to be available to any/all of the network video system decoders.
6. Receive and decode streams from any of the network video encoders for HDMI output.
7. Minimum stereo audio support.
8. Receiving, switching, and outputting analog or embedded digital stereo audio with each video input/output.
9. Support for audio de-embedding and breakaway audio routing.
10. Power over Ethernet (PoE) or PoE+ power
11. Control signal insertion.
12. Infrared and RS232 control ports for controlling endpoint devices.
13. HDCP compliant.
14. Automatic EDID management.
15. LAN, HDMI input, HDMI output, analog stereo audio input and output, USB, RS-232, and IR connectors.
16. Fully compatible with the A/V control system.
17. Fully compatible with the Owner's IP network switches. Coordinate with the Owner's IT group for detailed network configurations as required by the Owner and as recommended by the network video system manufacturer.
18. Low-profile to be able to be installed wall mounted and concealed behind a wall mounted monitor.

- B. Provide network video system and all encoders, decoders, and multi-window processors as manufactured by Crestron DM NVX series, or approved equal. Refer to the following items for detailed specifications for each device.

#### 2.4 NETWORK VIDEO ENCODER – COMMISSIONERS MEETING ROOM

- A. Provide network video encoders for HDMI and VGA video and embedded digital and analog audio input with the following features and capabilities:
1. Fully compatible with the network video system and the Owner's IP network.
  2. HDMI input.
  3. Support for all standard resolutions up to and including at minimum 3840x2160p60 with 4:4:4 chroma sampling.
  4. HDCP compliant.
  5. Automatic EDID management.
  6. Powered remotely by the Owner's PoE+ network switch over the same category-6a cable as is used for video data transmission.

7. Low profile form factor for mounting under tables, in lecterns, or as shown on the Contract Drawings. Provide all mounting brackets and accessories required. Refer to the Contract Drawings for additional details and requirements.

- B. Provide network video encoders as manufactured by Crestron model DM-NVX-E30 or approved equal.

## 2.5 NETWORK VIDEO DECODER – COMMISSIONERS MEETING ROOM

- A. Provide network video decoders for HDMI video, embedded digital audio, and control signals with the following features and capabilities:
  1. Fully compatible with the network video system and the Owner’s IP network.
  2. HDMI video output connector with support for embedded audio.
  3. Support for all standard resolutions up to and including at minimum 3840x2160p60 with 4:4:4 chroma sampling.
  4. HDCP compliant.
  5. Automatic EDID management.
  6. RS-232 and IR control capabilities for control of monitors and related devices.
  7. Powered remotely by the Owner’s PoE+ network switch over the same category-6a cable as is used for video data transmission.
  8. Low-profile form factor enabling concealed mounting behind video monitors or as shown on the Contract Documents. Provide all mounting brackets and accessories required. Refer to the Contract Drawings for additional details and requirements.
- B. Provide network video decoders as manufactured by Crestron Model DM-NVX-D30 or approved equal.

## 2.6 NETWORK VIDEO ENCODER/DECODER – CAFÉ A 2222 / CAFÉ B 2223 / TRAINING 2234 / TRAINING 2332

- A. Provide network video encoder/decoders for HDMI video, embedded digital audio, and control signals with the following features and capabilities:
  1. Combined IP network video encoder, IP network video decoder, and 2x1 video switcher in a single unit. This shall provide the functionality for the rooms to be able to be combined for larger events – any unit shall be able to transmit (encode) or receive (decode) based on control signals from the A/V Control System.
  2. Fully compatible with the network video system and the Owner’s IP network.
  3. HDMI input.
  4. HDMI video output connector with support for embedded audio.
  5. Support for all standard resolutions up to and including at minimum 3840x2160p60 with 4:4:4 chroma sampling.
  6. HDCP compliant.

7. Automatic EDID management.
8. RS-232 and IR control capabilities for control of monitors and related devices.
9. Powered remotely by the Owner's PoE+ network switch over the same category-6a cable as is used for video data transmission.
10. Low-profile form factor enabling concealed mounting behind video monitors or as shown on the Contract Documents. Provide all mounting brackets and accessories required. Refer to the Contract Drawings for additional details and requirements.

- B. Provide network video decoders as manufactured by Crestron Model DM-NVX-360 or approved equal.

## 2.7 LED BACKLIT LCD MONITORS

- A. Provide LED backlit LCD monitors with the following features:

1. 46" class, 55" class, 65" class, or 70" class diagonal as indicated for each location on the Contract Drawings.
2. LED backlit LCD Display.
3. Resolution: minimum 1920 x 1080.
4. Aspect Ratio: 16:9.
5. Brightness: at minimum 350 cd/m<sup>2</sup>.
6. Contrast Ratio: at minimum 5000:1.
7. Viewing Angle: at minimum 176°H 176°V.
8. At minimum three (3) HDMI inputs.
9. At minimum one (1) analog stereo audio input and one (1) analog stereo audio output
10. Built-in speakers.
11. RS-232 and IP network control ports for control from the A/V Control System.
12. Infrared remote control as a backup method for control.
13. Fully compatible with the associated computer video output, network video system decoder, or digital signage player as shown for each location.
14. Rated for Commercial use and at minimum 16 hours per day 7 days per week operation.
15. Where shown, provide new full pull-out and pivot wall mount to allow the monitor to be pulled away from the wall for maintenance and access to the A/V equipment secured behind the monitor. Provide Chief Manufacturing Thinstall series TS525TU swing arm mounts with all required accessories or approved equal.
16. Where shown, provide new recessed in-wall storage box for securing and concealing A/V devices and equipment behind the wall mounted monitor. Storage box shall be fully compatible with the monitor mount so as to be recessed and so as not to obstruct equipment access. Storage box shall be sized as appropriate to contain all associated A/V devices,

including but not limited to the Crestron UC Bracket Assembly. Provide Chief Manufacturing Thinstall In-Wall Enclosure series TA500 or approved equal.

17. Where shown, provide new rolling mobile monitor cart for flexible video monitor locations. Cart shall provide height adjustment with minimum height 2-feet or less and maximum height 2-feet or greater. Cart shall provide minimum 15-degree tilt adjustment to be suitable for viewing by the Commissioners seated at the dais while the display is positioned lower than the seated Commissioners so as not to obstruct view of the Commissioners from the audience. Provide Chief Manufacturing PFQUB or approved equal.

- B. LED LCD monitor shall be as manufactured by Sharp, Samsung, LG, NEC, or approved equal.

## 2.8 DIGITAL SIGNAGE / DIGITAL DIRECTORY / DIGITAL CUEING SYSTEM

- A. Provide system for managing and displaying digital signage, digital directory, and digital cueing as shown on the Contract Drawings.
- B. The system shall consist of digital signage players hardware, content and device management software for centralized management, integration with the wall-mounted video monitors as shown on the Contract Drawings, and integration with the Owner's IP network.
- C. Coordinate with the Owner to install the content and device management software onto a networked computer as provided and designated by the Owner. The content itself shall be created and managed by the Owner, but the Contractor shall deploy sample content in order to demonstrate that the system is complete and fully functional.
- D. Provide digital signage player hardware as recommended by the content and device management software. The hardware shall be small-form-factor or low-profile so as to be able to be installed concealed behind the wall-mounted video monitors.
- E. The content and device management software shall meet all of the following requirements at minimum:
  1. Fully compatible with the digital signage player hardware and software.
  2. Custom and template-based content.
  3. Individually configurable user accounts.
  4. Role-based access controls and permissions.
  5. Capable of integrations to various configurable content sources including but not limited to displaying clocks, countdowns, calendars, directories, cues, images, recorded videos, live videos, RSS feeds, emergency alerts, weather, and web pages.
  6. Fully configurable playlists with daily scheduling.
  7. Capability to configure requirements for content approval prior to deployment.
  8. Grouping multiple players for group-based configuration, control, and content management.
  9. Complete remote management and reporting of the player hardware and software, including remote content management, scheduling, updates, and health checks.

- F. Provide digital signage / digital directory / digital cueing systems as manufactured by Tightrope Carousel, Scala, BrightSign, NoviSign or approved equal.

## 2.9 WIRING

- A. Network video system devices shall use U/UTP Category-6a cabling in accordance with the manufacturers' recommendations. Provide cabling to connect the A/V system input/output outlets to the network switches as shown on the Contract Drawings. Cable jacket shall be PURPLE – refer to Specifications Section 271000 for additional details.
- B. All wiring shall be of the type, size, and quality necessary to maintain the signal characteristics required to meet the overall A/V system minimum performance requirements.
- C. The type and characteristics of all wiring shall be confirmed with the A/V system manufacturers. Where the manufacturers minimum requirements are different from those specified herein, the higher quality cabling shall be provided at no additional cost to the Owner.
- D. Signal levels shall be maintained within the A/V system manufacturers specified limits at all interfacing and connection points. Provide distribution amplifiers/line drivers as required to meet distribution requirements.
- E. HDMI cabling shall be type “premium high speed” and capable of transmitting at minimum 18Gbps bandwidth signals. Cable shall support at minimum 4096x2160 resolution at minimum 60Hz frame rate with 8-bit color depth and 4:4:4 chroma subsampling. HDMI cabling shall be fully compatible with the sources and displays for which it is used. Provide cable with conductor gauge that is at minimum 24AWG or as required to support transmission of the bandwidth required over the distance required. Provide cable equalizers or active optical cables if required to maintain full UHD capabilities over the length of cable required for each location.

## 2.10 OUTLETS AND OUTLET PLATES

- A. Provide new outlets and outlet plates at all locations as shown on the Contract Drawings. Refer to the Contract Drawings for additional details and requirements.
- B. All new outlets and outlet plates shall have finish as selected by the Owner and Architect to match other finishes.
- C. All new outlet plates shall have custom engraved labeling of all outlets with a labeling scheme as defined by the Owner.

## PART 3 - EXECUTION

### 3.1 INSPECTION AND PREPARATION WORK

- A. This contractor shall examine the conditions under which the system installation is to be performed and notify the Owner's Representative or Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.
- B. Prior to the start of systems installation, meet at the project site with the Design Professional and all trades involved to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other

work which penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

### 3.2 SPECIFIC INSTALLATION REQUIREMENTS

- A. Equipment shall be installed in strict accordance with manufacturers' instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered as if part of these Specifications.
- B. If a major deviation from the drawings is indicated by practical considerations, the Contractor shall consult with the Design Professional for resolution, and shall submit shop drawings, showing all deviations in such detail as will clearly indicate the necessity or desirability for the change.
- C. Shielded cables shall maintain shield continuity. Shields shall not be grounded except at the control panel with single point grounding per manufacturers' recommendations.
- D. Unless specifically dimensioned on the drawings, the locations of equipment are approximately correct. The exact location and arrangement shall be determined as the work progresses to conform in the best possible manner with its surroundings. All such locations and arrangements shall be approved by the Design Professional or Owner, as applicable, before installation. Coordinate with other trades to ensure that all equipment is installed in locations that shall not create any undesirable conditions.
- E. The Contractor shall coordinate the placement of all devices in relation to lectern cabinets, tables, desks, structural panels, trims, moldings, etc. Examine Design Professional's detailed drawings and also, all drawings, catalog cuts, etc. for special apparatus which must be roughed-in and connected. Coordinate with Design Professional. Outlets, apparatus, and related connections which are improperly located through failure to follow the above instructions, shall be subject to correction and/or relocation without extra charges to the Owner.

### 3.3 ADJUSTING, TESTING AND CLEANING

- A. Test Procedures
  - 1. System tests shall be performed based on approved test procedures.
  - 2. Test Procedures shall be developed by the contractor and reviewed by the manufacturers.
- B. Adjusting of Systems
  - 1. All system components shall be adjusted for optimum performance under the local conditions particular to the project.
- C. Refer to sections 270500 and 270510 for additional details and requirements.

### 3.4 SYSTEM ACCEPTANCE

- A. The contractor shall schedule the final acceptance tests with the Owner and Design Professional at a mutually agreed time. The contractor shall notify the Owner and Design Professional a minimum 2 weeks in advance of the intended final acceptance time.

- B. Should any part of a system fail during the acceptance tests to perform according to the contract documents, the entire system shall be re-tested at an Owner approved time.
- C. The contractor shall correct all deficiencies which are unacceptable to the Owner and its representatives and provide a complete and functional system as shown and specified in the contract documents.
- D. The contractor shall record and submit the final test results as specified herein.
- E. Acceptance of the systems will not be considered by the Owner until all deficiencies have been corrected.
- F. Beneficial use of the systems shall not be considered as acceptance.

3.5 TRAINING

- A. Refer to Sections 270500 and 270510 for requirements.

END OF SECTION 274117

## **SECTION 274118 – A/V CONTROL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Specification.
- B. Refer to all Contract Drawings and Specifications listed in Section 270500 for additional requirements.
- C. Refer to Divisions 26 and 28 Specifications for coordination information.

#### 1.2 SYSTEM DESCRIPTION

- A. A/V Systems shall be provided as shown on “T” Contract Drawings and these Specifications.
- B. The A/V Control Systems shall include, but not be limited to, the following:
  - 1. Remote control of audio and video (A/V) systems from locations shown on the Contract Drawings.
  - 2. Wired touch screen control panels with web conferencing provider native software controls and custom graphical user interfaces (GUI’s) for unique in-room device controls.
  - 3. A/V control system processors for control and management where shown.
  - 4. Integration with all A/V system devices for full control of all user-adjustable and user-selectable features and functions.

#### 1.3 SYSTEM OPERATION

- A. The A/V system administrators and users shall interface to the A/V Systems via touch screen control panels where shown.
- B. The web conferencing provider’s native control software shall be the default control interface at system startup. This interface shall be designed specifically for ease of use by presenting upcoming meetings for one-touch-join, or one-touch-join to start a new meeting. Provide integration with the Owner’s web conferencing accounts and with the Owner’s calendaring system for meeting and room scheduling.
- C. Where rooms have additional in-room A/V devices to be controlled, there shall be a supplementary GUI page for control of these local devices by advanced users. Local device controls shall include but not be limited to: microphone levels, microphone mutes, speaker levels, video routing, display power controls, PTZ camera controls, camera selection, room combining/separating, and overflow viewing enabling/disabling. This interface shall include the following control items:
- D. An advanced user interface shall be accessible via an Advanced Settings button on the standard user simplified interface. This advanced interface shall be designed to offer full, granular control of all A/V system components’ settings and features to an A/V system administrator or advanced end-user. This interface shall include the following control items:

1.4 DESCRIPTION OF WORK

A. The Work includes, but is not necessarily limited to providing, all equipment, labor, materials and technical services as follows and as shown on the Contract Drawings.

1. Typical Large Conference Rooms

- a. Provide tabletop touch screen control panel.
- b. Provide advanced controls for audio levels and mute controls through integration with the digital audio processing and matrix mixing software running on the web conferencing computer. Provide mute indicator light synchronization.
- c. Provide controls for local A/V presentations (i.e. no active web conferencing call).
- d. Provide controls for “Bring-Your-Own-Meeting” (BYOM) functionality wherein a web conference is controlled by and run on an Owner-provided laptop or similar.
- e. Provide input/output panels for control and data.
- f. Provide all other control equipment and features as shown on Contract Drawings.

2. Typical Medium Conference Rooms and Typical Small Meeting Rooms and Director Offices

- a. Provide tabletop touch screen control panel.
- b. Provide controls for local A/V presentations (i.e. no active web conferencing call).
- c. Provide controls for “Bring-Your-Own-Meeting” (BYOM) functionality wherein a web conference is controlled by and run on an Owner-provided laptop or similar.
- d. Provide input/output panels for control and data.
- e. Provide all other control equipment and features as shown on Contract Drawings.

3. Typical Training Room – typical for **Training Rooms 2312 and 2543 only**

- a. Provide wall-mounted touch screen control panel.
- b. Provide small control system processor to provide PTZ controls of the ceiling-mounted web conferencing cameras. Provide manual PTZ controls and presets with set and recall functionality.
- c. Provide advanced controls for audio levels and mute controls through integration with the digital audio processing and matrix mixing software running on the web conferencing computer. Provide mute indicator light synchronization.
- d. Provide controls for local A/V presentations (i.e. no active web conferencing call).
- e. Provide controls for “Bring-Your-Own-Meeting” (BYOM) functionality wherein a web conference is controlled by and run on an Owner-provided laptop or similar.
- f. Provide input/output panels for control and data.
- g. Provide all other control equipment and features as shown on Contract Drawings.

4. **Café A 2222, Café B 2223, Training 2224, and Training 2232**

- a. Provide wall-mounted touch screen control panels.
  - b. Provide control system processor to provide controls for the following. Provide these controls on the supplementary advanced controls page(s) of the GUI.
    - 1) PTZ controls of the ceiling-mounted web conferencing cameras. Provide manual PTZ controls and presets with set and recall functionality.
    - 2) Room combining and separating.
    - 3) Video routing.
    - 4) Audio level and mute controls for the combined spaces as controlled through the networked digital audio matrix mixer in the IDF room 2202. Provide mute indicator light synchronization.
    - 5) System and display power on/off.
  - c. Provide controls for local A/V presentations (i.e. no active web conferencing call).
  - d. Provide controls for “Bring-Your-Own-Meeting” (BYOM) functionality wherein a web conference is controlled by and run on an Owner-provided laptop or similar.
  - e. Provide input/output panels for control and data.
  - f. Provide all other control equipment and features as shown on Contract Drawings.
5. Café 1110
- a. Provide integration into the Commissioners Meeting Room 1240 A/V Control System for control of overflow viewing.
    - 1) When overflow viewing is enabled from the touch screen control panel in the Commissioners Meeting Room, the Commissioners Meeting Room IP networked video streams shall be sent to the network video decoders in Café 1110, and the Commissioners Meeting Room IP networked audio streams shall be sent to the networked audio power amplifier in Café 1110.
    - 2) When overflowing viewing is enabled, the wall-mounted monitors in Café 1110 shall automatically power on if they are not already powered on. The video input on the monitors shall automatically switch to the network video decoder upon activation of the overflow viewing and shall automatically switch back to the digital signage player upon deactivation of overflow viewing.
    - 3) Café 1110 speaker audio levels shall be controllable from the Commissioners Meeting Room touch screen control panel, although the levels should generally be optimized and seldom if ever adjusted.
    - 4) Unless overflow mode is active, the Café 1110 wall-mounted video monitors shall otherwise power on or off in accordance with the schedule configured in the digital signage management system.
6. Typical Lobby
- a. The wall-mounted video monitors shall power on or off in accordance with the schedule configured in the digital signage management system.

7. Waiting Room 2110
  - a. The wall-mounted video monitors shall power on or off in accordance with the schedule configured in the digital signage management system.
  - b. Speaker audio levels shall be optimized for the local conditions, and re-optimized once the building is fully occupied and in-use. Audio level controls are not required to be accessible for end-users, but shall be configurable by the Contractor or Owner's IT Administrator via the audio power amplifier's control interface.
8. Commissioners Meeting Room
  - a. Provide tabletop-mounted touch screen control panel.
  - b. Provide control system processor to provide controls for the following. Provide these controls on the supplementary advanced controls page(s) of the GUI.
    - 1) PTZ controls of the ceiling-mounted web conferencing cameras. Provide manual PTZ controls and presets with set and recall functionality. Provide controls for selection of which of the cameras should be active for use in web conferences and/or overflow viewing.
    - 2) Full matrix video routing controls with the ability to route any input to any output. Generally, and by default, a single selected video input shall automatically route to all displays. However, the system shall be capable to route any input to any output in any combination.
    - 3) Audio level and mute controls for each individual microphone and speaker zone. Provide mute indicator light synchronization.
    - 4) System and display power on/off.
    - 5) Integration with Café 1110 for full control of overflow viewing of proceedings in Commissioners Meeting Room 1240 remotely in Café 1110. Refer to the requirements for Café 1110 for additional details.
  - c. Provide controls for local A/V presentations (i.e. no active web conferencing call).
  - d. Provide input/output panels for control and data.
  - e. Provide all other control equipment and features as shown on Contract Drawings.
9. Network:
  - a. Coordinate with the Owner's IT group to provide integration of the new A/V control system components into the Owner's IP network in accordance with the Owner's requirements and the A/V control system device manufacturer's recommendations. This shall include, but not be limited to, virtual local area networks (VLAN's), IP addresses, multicast, quality of service (QoS), and the enabling, disabling, or configuration of all network protocols and services as required to meet the Owner's standard network security requirements.
  - b. Provide network configurations for all new A/V control system devices in accordance with the coordination with the Owner's IT group.
  - c. Provide full documentation of all network configurations and settings for the Owner's records and management systems.

1.5 RELATED WORK

- A. In addition to work described above, the Work Shall include, but not necessarily be limited to, the following:
  - 1. Certain rigging of equipment and materials as specified for this Contract.
  - 2. Assemble equipment furnished disassembled.
  - 3. Testing and energizing as specified.
  - 4. Cleaning as specified for this Contract.
  - 5. Equipment identification as specified.
  - 6. Furnishing and installation of all low voltage wires and cables into conduit and box system provided by others.
  - 7. Miscellaneous steel and hangers required for support of electrical equipment.

1.6 SUBMITTALS

- A. Refer to Section 270510.

**PART 2 - PRODUCTS**

2.1 OVERVIEW

- A. The equipment described herein is intended to provide a reference for the Audio/Video Control System (AVCS), and it is to be provided as shown on the Contract Drawings.
- B. Certain equipment described may not be applicable to all methods of implementation. All devices required to complete the installation may not be described. It is the responsibility of the contractor to provide a complete working system in coordination with the system vendors.
- C. All system components shall be approved for the function they will perform. Devices that require modification for these applications shall not be approved.
- D. The products specified herein were the latest generation at the time of specification and provide the functionality and intent of the system requirements. The Contractor shall provide, at the time of product submittal, the manufacturers latest generation of products, hardware, and software, with equal or greater functionality.

**2.2 AUDIO/VIDEO CONTROL SYSTEMS – COMMISSIONERS MEETING ROOM AND CAFÉ  
A 2222 / CAFÉ B 2223 / TRAINING 2224 / TRAINING 2232**

- A. The Contractor shall provide all required remote control equipment, modules, power supplies, wiring, relays, etc., whether listed herein or not, to provide a perfectly operational system with no glitches, bugs, or impediments which would otherwise detract from proper system operation. Contractor shall be informed through thorough investigation of Manufacturer recommendations and requirements and shall meet all remote control requirements as required by Design Professional and Owner.
- B. Provide AVCS's with the following features and capabilities:

1. Fully compatible with the digital audio processing and matrix mixing systems for full control of all audio functions.
  2. Fully compatible with the video systems for full control of all functions and insertion of control signals into network video encoders and decoders.
  3. Fully compatible with the power controllers of all controlled devices to support power up and shutdown functions.
  4. Fully compatible with all source, display, and output equipment for control as specified in this section.
  5. Input/output ports as required to support control and functionality of all devices as described in the Division 27 specifications.
  6. Support for RS-232/422/485 serial, IR, relay, analog I/O, digital I/O, and Ethernet control ports as required for complete and fully functional control over all devices as described by this section.
  7. Fully compatible with the touch screen control panels to support graphical user interface programs.
  8. Minimum 2GB internal memory and 8GB flash storage as required to support all system requirements.
  9. Rack-mountable – provide all required rack-mounting accessories.
  10. Fully compatible with the Owner’s IP network and required configurations.
- C. Provide Audio/Video Control Systems as manufactured by Crestron model CP4 or approved equal with all required accessories.

### 2.3 AUDIO/VIDEO CONTROL SYSTEMS – TYPICAL TRAINING ROOMS

- A. The Contractor shall provide all required remote control equipment, modules, power supplies, wiring, relays, etc., whether listed herein or not, to provide a perfectly operational system with no glitches, bugs, or impediments which would otherwise detract from proper system operation. Contractor shall be informed through thorough investigation of Manufacturer recommendations and requirements and shall meet all remote control requirements as required by Design Professional and Owner.
- B. Provide AVCS’s with the following features and capabilities:
1. Fully compatible with the digital audio processing and matrix mixing systems for full control of all audio functions.
  2. Fully compatible with the power controllers of all controlled devices to support power up and shutdown functions.
  3. Fully compatible with all source, display, and output equipment for control as specified in this section.
  4. Input/output ports as required to support control and functionality of all devices as described in the Division 27 specifications.

5. Support for RS-232/422/485 serial, IR, relay, analog I/O, digital I/O, and Ethernet control ports as required for complete and fully functional control over all devices as described by this section.
  6. Fully compatible with the touch screen control panels to support graphical user interface programs.
  7. Minimum 1GB internal memory and 8GB flash storage as required to support all system requirements.
  8. Small-form-factor to be able to be fully contained and concealed in the in-wall A/V storage boxes behind the wall-mounted video monitors – provide all required mounting accessories.
  9. Fully compatible with the Owner’s IP network and required configurations.
- C. Provide Audio/Video Control Systems as manufactured by Crestron model RMC4 or approved equal with all required accessories.

#### 2.4 WIRED TOUCH SCREEN CONTROL PANELS – TABLETOP-MOUNTED CONSOLES

- A. Where shown, provide touch screen control panels which are integral to the tabletop-mounted web conferencing consoles as shown on the Contract Drawings and as specified in Specifications Section 274117.
- B. The touch screen control panels in the tabletop-mounted web conferencing consoles shall have all of the following features and capabilities at minimum:
1. 7” diagonal viewable area screen with at minimum 1280x800 resolution.
  2. Capacitive multi-touch TFT active matrix color LCD display
  3. Fully compatible with and loaded with the web conferencing provider’s native web conferencing software. Additionally, fully compatible with and loaded with custom GUI for in-room device controls where specified.
  4. Powered through the web conferencing console power supply.
  5. Power saving features including auto-brightness and standby mode.
  6. Fully compatible with the AVCS.
- C. Provide tabletop-mounted wired touch screen control panels as part of the web conferencing system packages as specified in Specifications Section 274117 and as shown on the Contract Drawings as manufactured by Crestron UC-MX50-T and UC-MX70-T or approved equal with all required mounts and accessories as required for a complete and fully functional system as described by the Contract Documents.

#### 2.5 WIRED TOUCH SCREEN CONTROL PANELS - TABLETOP MOUNTED

- A. Where shown, provide wired touch screen control panels with at minimum the following features and capabilities at minimum:
1. 10” diagonal viewable area screen with at minimum 1920x1200 resolution.
  2. PoE or PoE+ powered.

3. Power saving features including auto-brightness and standby mode.
  4. Tabletop mounting form factor. Provide stand as required to stand up by itself when placed on the table.
  5. Brightness: at minimum 400 nits.
  6. Contrast: at minimum 1000:1.
  7. Viewing angles: at minimum +/- 80° horizontal, +/-80° vertical.
  8. Projected Capacitive multi-touch screen.
  9. Memory: 2GB RAM, 16GB flash.
  10. Fully compatible with the AVCS.
- B. Provide tabletop-mounted wired touch screen control panels as part of the web conferencing system packages as specified in Specifications Section 274117 and as shown on the Contract Drawings as manufactured by Crestron UC-CX100-T or approved equal with all required mounts and accessories as required for a complete and fully functional system as described by the Contract Documents.

## 2.6 WIRED TOUCH SCREEN CONTROL PANELS – WALL-MOUNTED

- A. Where shown, provide wired touch screen control panels with at minimum the following features and capabilities at minimum:
1. 10” diagonal viewable area screen with at minimum 1920x1200 resolution.
  2. PoE or PoE+ powered.
  3. Power saving features including auto-brightness and standby mode.
  4. Wall-mounting form factor. Provide backbox, trim, and all required accessories for recess-mounting in finished wall.
  5. Brightness: at minimum 400 nits.
  6. Contrast: at minimum 1000:1.
  7. Viewing angles: at minimum +/- 80° horizontal, +/-80° vertical.
  8. Projected Capacitive multi-touch screen.
  9. Memory: 2GB RAM, 16GB flash.
  10. Fully compatible with the AVCS.
- B. Provide wall-mounted wired touch screen control panels as part of the web conferencing system packages as specified in Specifications Section 274117 and as shown on the Contract Drawings as manufactured by Crestron UC-CX100-T-WM or approved equal with all required mounts and accessories as required for a complete and fully functional system as described by the Contract Documents.

2.7 A/V NETWORK SWITCHES

- A. All network switches shall be provided, configured, and managed by the Owner's IT group. Coordinate with the Owner's IT group for detailed network and networked device configurations, including but not limited to virtual local area networks (VLAN's), IP addresses, multicast, quality of service (QoS), and the enabling, disabling, or configuration of all network protocols and services as required to meet the Owner's standard network security requirements.

2.8 EQUIPMENT RACKS

- A. Refer to Specifications Section 271000 and the Contract Drawings for additional details. Coordinate with the Owner for the available equipment rack mounting space that shall be used in each room.

2.9 UNINTERRUPTIBLE POWER SUPPLY

- A. For all A/V equipment which is rack-mounted in an IT equipment room, coordinate with the Owner's IT group for A/V device power requirements and connectivity to the UPS power distribution systems.

2.10 WIRING

- A. Provide all wiring necessary to connect the AVCS system input/output outlets to the AVCS system processing, switching, and distribution equipment. All wiring shall be of the type, size and quality necessary to maintain the signal characteristics required to meet the overall AVCS system minimum performance requirements.
- B. The type and characteristics of all wiring shall be confirmed with the AVCS system manufacturers. Minimum acceptable cabling type for network-based control shall be Category-6a U/UTP. Cable jacket shall be PURPLE – refer to Specifications Section 271000 for additional details and requirements. Where the manufacturers minimum requirements are different from those specified herein the higher quality cabling shall be provided at no additional cost to the Owner.
- C. Signal levels shall be maintained within the AVCS system manufacturers specified limits at all interfacing and connection points.
- D. All network cabling shall be Category-6 unshielded twisted pair and shall meet or exceed all requirements of EIA/TIA-568-C. Refer to Specifications Section 271000 for additional details and requirements.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION WORK

- A. This contractor shall examine the conditions under which the system installation is to be performed and notify the Owner's Representative and Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.
- B. Prior to the start of systems installation, meet at the project site with the Design Professional and all trades involved to coordinate efforts. Review areas of potential interference and resolve

conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other work which penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

### 3.2 SPECIFIC INSTALLATION REQUIREMENTS

- A. Equipment shall be installed in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered as if part of these Specifications.
- B. If a major deviation from the drawings is indicated by practical considerations, the Contractor shall consult with the Design Professional for resolution, and shall submit shop drawings, showing all deviations in such detail as will clearly indicate the necessity or desirability for the change.
- C. Shielded cables shall maintain shield continuity. Shields shall not be grounded except at the control panel with single point grounding per manufacturers' recommendations.
- D. Unless specifically dimensioned on the drawings, the locations of equipment are approximately correct. The exact location and arrangement shall be determined as the work progresses to conform in the best possible manner with its surroundings. All such locations and arrangements shall be approved by the Design Professional or Owner, as applicable, before installation. Coordinate with other trades to ensure that all equipment is installed in locations that shall not create any undesirable conditions.
- E. The Contractor shall coordinate the placement of all devices in relation to lectern cabinets, tables, desks, structural panels, trims, moldings, etc. Examine Design Professional's detailed drawings and also, all drawings, catalog cuts, etc. for special apparatus which must be roughed-in and connected. Coordinate with Design Team. Outlets, apparatus, and related connections which are improperly located through failure to follow the above instructions, shall be subject to correction and/or relocation without extra charges to the Owner.

### 3.3 ADJUSTING, TESTING AND CLEANING

- A. Test Procedures
  - 1. System tests shall be performed based on approved test procedures.
  - 2. Test Procedures shall be developed by the contractor and reviewed by the manufacturers.
- B. Adjusting of Systems
  - 1. All system components shall be adjusted for optimum performance under the local conditions particular to the project.
- C. Refer to sections 270500 and 270510 for additional details and requirements.

### 3.4 SYSTEM ACCEPTANCE

- A. The contractor shall schedule the final acceptance tests with the Owner and Design Professional at a mutually agreed time. The contractor shall notify the Owner and Design Professional a minimum 2 weeks in advance of the intended final acceptance time.

- B. Should any part of a system fail during the acceptance tests to perform according to the contract documents, the entire system shall be re-tested at an Owner approved time.
- C. The contractor shall correct all deficiencies which are unacceptable to the Owner and its representatives and provide a complete and functional system as shown and specified in the contract documents.
- D. The contractor shall record and submit the final test results as specified herein.
- E. Acceptance of the systems will not be considered by the Owner until all deficiencies have been corrected.
- F. Beneficial use of the systems will not be considered as acceptance.

3.5 TRAINING

- A. Refer to Sections 270500 and 270510 for requirements.

END OF SECTION 274118

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**SECTION 280500 - COMMON WORK RESULTS FOR SECURITY SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions, Divisions 01, 26, 27, and 28 and the following Specifications and Drawings apply to work of this Section.
- B. Refer to all contract drawings and specifications listed in this Section for additional requirements.
  - 1. Construction Specification Sections:
    - a. Section 280500 Common Work Results for Security Systems
    - b. Section 280510 Special Requirements for Security Systems
    - c. Section 281300 Access Control and Intrusion Detection System
    - d. Section 281523 Security Intercom System
    - e. Section 282300 Video Surveillance System
  - 2. Drawings – T Series
- C. Sections 280500 and 280510 are supplementary to the Division 1 specifications.
- D. Refer to Divisions 26, 27, and 28 Specifications for coordination information.

1.2 CODES, STANDARDS AND REGULATIONS

- A. All work of Division 28, and the works of the related sections shall comply with the latest codes, standards and regulations of the following:
  - 1. National Electric Code (NEC)
  - 2. National Fire Protection Association (NFPA).
  - 3. International Building Code (IBC).
  - 4. Underwriters' Laboratories (UL).
  - 5. National Electrical Manufacturers Association (NEMA).
  - 6. Instrument Society of America (ISA).
  - 7. Institute of Electrical & Electronic Engineers (IEEE).
  - 8. Federal, State, and Local Ordinances.
  - 9. Federal Communications Commission (FCC) Regulations.
  - 10. Americans with Disabilities Act (ADA).
  - 11. Federal Communications Commission (FCC) Regulations.

12. American National Standards Institute (ANSI).
13. Telecommunication Industries Association (TIA).
14. Electronic Industries Association (EIA).
15. Building Industry Consulting Service International (BICSI)

### 1.3 SUMMARY OF PROVISIONS IN THIS SECTION

- A. This Section includes:
1. A general description of the work requirements for the security systems.
  2. Quality assurance of the Security Electronic Systems (SES) Contractor and all sub-contractors.
  3. Qualification requirements for all technical personnel of the SES Contractor and subcontractors assigned.
  4. Coordination of the Security Systems work with the work of other trades.
  5. Definitions of word usage within and interpretation of these contract documents.
  6. Wire management, cable, labeling, identification, splicing, surge, and general requirements of the security systems.
  7. Installation, adjusting, and cleaning of the security and detection equipment.

### 1.4 GENERAL REQUIREMENTS

- A. Provide all work specified on each contract drawing and specification. The contract drawings, specifications, addendums, and bulletins are complementary; what is shown on each contract document shall be provided as if it is shown on all contract drawings and specifications.
- B. The work listed in this section is only a summary of work required for this project. Refer to all contract documents for the complete description of work required.
- C. Refer to general and supplementary contract provisions sections for more details and coordination.
1. Penetrations.
  2. Painting and patching.
  3. Conduits, back boxes, and wire ways.

### 1.5 GENERALIZED DESCRIPTION OF WORK

- A. The contractual obligations for Security Electronics Systems (SES) Contractor responsible for the Security Systems work shall refer to, supply, installation, wiring, configuration, integration, testing, repair, and maintenance of the Security Systems including labor and materials by the approved Contractor.

- B. The SES Contractor shall provide all Security work described in Division 28 Specifications, Security Systems work shown on “T” Contract Drawings, and related work shown on other drawings. The SES shall be defined as the Contractor, all Sub-contractors, and manufacturer personnel providing work specified in Division 28. The SES Contractor shall refer to all Contract Drawings and Specifications for a complete definition of work required. The following is only a generalized summary of work required.
1. Provide color-coded and labeled conductors and cables required for systems outlined in this section.
  2. Coordinate electrical work including Division 28 work which is to be installed in conduits, raceways and infrastructure, wire management, backboxes, wiring, and UPS power with provided by the Electrical Contractor.
  3. Provide single point grounding of all Security and Communication Systems Components and circuits provided under this Contract.
  4. Provide all submittals, testing, certification, warranties, training materials, etc. as outlined under the Special Requirements Section 280510.
  5. Provide security racks and infrastructure as shown on the Contract Drawings. Refer to Division 27 Specifications for requirements for Structured Cabling System.
  6. Provide Access Control System as outlined under Section 281300, including but not limited to card readers, control panels, power supplies, motion sensors, keypads, cabling, configuration, communication modules, and integration. Coordinate with the door hardware schedule and Division 08 requirements for electronic door hardware.
  7. Provide Security Intercom System as outlined under Section 281523, including but not limited to intercom substations, video intercom substations, master video intercom stations, cabling, configuration, communication modules, and integration.
  8. Provide Video Surveillance System as outlined under Section 282300, including but not limited to cameras, recording servers, network switches, patch panels, surge protection, cabling, mounts, accessories, configuration and integration.
  9. Coordinate single point grounding of each Security Systems components and circuits with the General Contractor and Electrical Contractor.
  10. Coordinate with the Division 26 Electrical Contractor to provide UPS backup power for all Security systems under this project.
  11. Coordinate to provide all Electrical work required to support the Security systems, including but not limited to panelboards, wiring, conduit, and receptacles. Refer to ‘E’ series drawings and Division 26 Electrical specifications for additional details. Provide all security equipment wiring, power supplies, console receptacles, power distribution strips and connections.
  12. Provide security fasteners for installation of all devices. Provide tamper-proof fasteners in all areas exposed to the public.
  13. Provide complete configuration and integration of Security Systems as outlined within the Contract Documents.

14. Provide two (2) years on-site service warranty for all parts and labor. Provide Spare Parts/Service Contract for equipment intended to be used after expiration of the warranty.
15. Provide training on all equipment and all training materials.
16. Coordinate all work with other contractors as necessary, including door installer and Electrical Contractor, to ensure fully integrated and fully functioning Security Systems.

#### 1.6 RELATED WORK

- A. Related work includes, but is not limited to, the following:
  1. Miscellaneous steel and hangers required for the support of electrical equipment.
  2. Wire labeling and equipment identification as specified herein and elsewhere.
  3. Assembly of equipment furnished disassembled.
  4. Cleaning of all apparatus specified elsewhere.

#### 1.7 EQUIPMENT NOT-IN-CONTRACT (NIC)

- A. Certain pieces of technology equipment shown on the Contract Drawings are not included within this bid. These items are shown on the Contract Drawings with the identification of “NIC” (Not Included in Contract).
- B. Certain pieces of technology equipment and infrastructure shown in the Contract Drawings are existing and shall be fully integrated into the complete and fully functional solution described by the Contract Documents. Refer to the Contract Drawings and Specifications for additional details specific to each existing piece.
- C. Refer to the Responsibility Matrix in this section for additional details and requirements of contractual scope responsibilities.

#### 1.8 QUALITY ASSURANCE

- A. Contractor Definition
  1. The Contractor, as used in the Division 28 Security specifications and associated drawings refers to the Contractor with specific qualifications as defined by this section for the installation of these systems.
- B. Security Electronic SYSTEMS CONTRACTOR (SES) QUALIFICATION REQUIREMENTS
  1. Any Security Electronics Systems Contractor (SES) shall submit qualification data for approval as part of the submittal process. Verbal approval will not satisfy this requirement. All SES's shall submit and all information exactly as required. Grounds for disqualification shall exist if it is proven that the information submitted is inaccurate or, in the opinion of the Design Professional and Owner, does not satisfy the qualification requirements. If the submitted SES is disqualified, the Contractor shall submit an SES firm meeting stated qualifications at no additional cost to the Owner.
  2. The SES, all sub-contractors and their technical personnel, performing SES work shall have a minimum of five (5) years of proven experience in the installation and servicing of

systems of similar size, complexity, and performance. The proven, relevant experience requirement shall apply to all personnel providing Systems work on this project. Relevant experience shall be defined as systems with similar complexity and integration requirements as the work required under this Contract. The Contractor shall submit system description, details, and other information to demonstrate that they are qualified for this project. Submit qualification data, list of key personnel assigned to this project and references as specified in this section. The Design Professional and Owner shall have the opportunity to contact all contractor references and visit any of the referenced projects through arrangements and coordination provided by this contractor at no additional cost.

3. The SES Contractor may be the same contractor as the Division 26 Electrical Contractor or the Division 27 Communications Contractor provided the qualifications defined in this Section are met or exceeded.
4. In the event that the SES Contractor is a separate contractor to the Division 26 Electrical Contractor, they are required to coordinate with the Division 26 Electrical Contractor for all infrastructure location, sizing, scheduling, etc.
5. Personnel Requirements
  - a. The following personnel shall be assigned to the project with resumes submitted with technical proposal. Singular people may serve in two or more of these roles provided that they meet all qualification requirements for each role.
    - 1) Principal-in-Charge with QA/QC responsibility.
    - 2) Project Manager with QA/QC responsibility.
    - 3) Project Engineer with Network Certification, 5 years experience and Design responsibility with formal Electronics training and Operations knowledge and/or Certified Electronic Technician (CET) with Network Certification and 5 years experience.
    - 4) Field Technician with 5 years experience and certifications in the installed products.
    - 5) Programmer(s) with certifications for all software and manufacturers the Contractor will be provided for the project.
    - 6) Project Manager with QA/QC responsibility for infrastructure installations.
    - 7) Security Infrastructure Installer with (5) years systems installation experience for the critical coordination needs of the Owner and Design Professional.
  - b. Network certifications shall consist of BICSI and/or TIA certification as a minimum.
  - c. The SES Contractor shall be a Certified installer for the infrastructure provided under this contract with either “Advanced Category Installer” or “RCDD” certification. Proper training, certification, and annual reassessment must be current and documented by a leading category cabling, switching, and IT infrastructure manufacturer.
6. The SES shall submit the following qualification data:

- a. Evidence that the organization and technical personnel assigned to this project have a minimum of 5 years experience in successfully completing projects of equal scope, quality, type, and complexity to that required herein. Include resume(s) of personnel providing work for this project, with description of responsibilities on this project and referenced projects.
  - b. List of at least three (3) comparable projects, completed within the last 5 years, on which min. 80% of Security Systems work has been performed directly by the SES technical personnel that have been operational for a min. of two (2) years. Include for each facility the following:
    - 1) Name and location of Project.
    - 2) Name, address, and telephone number of the Design Professional.
    - 3) Name, address, and telephone number of the Owner.
    - 4) Name, address, and telephone number of General Contractor and Project Manager.
    - 5) Name, address, and telephone number of SES's Bonding Company for the individual project.
    - 6) Date of Occupancy.
    - 7) Contract Values: Entire Project and SES's portion.
    - 8) Type and size of systems provided.
  - c. The Contractors shall provide all detailed information requested during review and qualification process promptly to allow complete evaluation of contractor's qualifications, quality of work and warranty services provided for the referenced projects.
  - d. The Contractors shall be responsible for coordinating site visits to referenced projects.
7. All SES's shall be qualified and be responsible for directly performing the Security Systems work, shown on contract documents.
  8. The SES's installers shall have manufacturers' training on all systems being provided. If required, The Contractor shall provide on-site assistance of manufacturer's representative to aid in any installation or troubleshooting problems.
- C. All equipment and materials provided shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories listing where subject to Underwriters Laboratories label service (UL file numbers shall be available for all UL listed products upon request to substantiate the listing). All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of five (5) years unless stated otherwise in these specifications.
- D. Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code Ratings, UL label, or other data which is die-stamped

into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

- E. **Product Quality:** The products specified herein were the latest generation at the time of specification and provide the functionality and intent of the system requirements. The Contractor shall provide, at the time of product submittal, the manufacturers' latest generation of products, hardware and software, with equal or greater functionality.

#### 1.9 DEFINITIONS AND APPLICABILITY TO DIVISION 28 WORK:

- A. The definitions of this Section are intended to preserve and expand the applicability of definitions of the General Conditions for all Contract Documents. These definitions are intended to add requirements applicable to Division 28.
- B. In addition to the General Conditions, the following additional definitions shall apply to all Security Systems work:
  - 1. "PROVIDE" shall mean that the Contractor shall furnish, install, wire, test, adjust, start-up, program, interface and service all devices required for complete and operational Security Systems.
  - 2. "INTEGRATION" shall mean that this Contractor shall provide all systems interfacing and programming necessary to physically and logically connect multiple systems through hardware, software and project specific programming.
  - 3. "PROVIDE CABLING" shall mean that the Contractor shall provide cabling, wire labeling and termination, and coordinate wireway, wire mold, raceways, and conduits as specified for each type of location. Coordinate with requirements of Division 26 for acceptable conduit types.
  - 4. "RESPONSIBILITY OF THIS CONTRACTOR" shall mean the work shall be performed by this contractor under the overall direction and supervision of the Prime Contractor having a contract directly with the Owner.
  - 5. "New" shall mean unused and currently manufactured within one (1) year.

#### 1.10 INTERPRETATION OF CONTRACT DOCUMENTS

- A. This Section of the specifications and related drawings describe general provisions applicable to every Section of Division 28.
- B. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenance or accessories necessary to complete any required system or item of equipment are to be omitted. The Design Professional's interpretation of Contract Documents for minimum performance requirements shall be binding to the Contracts.
- C. The drawings utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural contract drawings and on equipment shop drawings. No interpretation shall be

made from the limitation of symbols and diagrams that any elements necessary for complete work are excluded.

- D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.
- E. Information as to the general arrangement of construction shall be derived from architectural and structural drawings and specifications only.
- F. The use of words in the singular shall not be considered as limited where other indications denote that more than one item is referred to.
- G. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions of detail drawings. For exact locations of building elements, refer to dimensioned drawings; however, field measurements take precedence over dimensioned drawings. Report to the GC any discrepancies discovered between "EY" security drawings and the drawings for other divisions of work.
- H. The Contract Drawings and Specifications are complementary; what is shown and required on one document shall be provided as if shown and required by all documents.
- I. Provide all materials for systems, resulting upon completion, in functioning systems in compliance with performance requirements specified. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from furnishing such parts.
- J. Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no additional cost to the Owner. Changes in electrical service to equipment due to substitutions of equipment by any contractors shall be at the cost of that contractor.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. When the SES substitutes equipment manufactured by a vendor other than the specified manufacturer, the Contractor shall be responsible for the operation of the product in the intended system, including all related costs required to make the design work, function, and fit in the allocated space. The Contractor shall submit all substitutions to the Design Professional for approval within 15 days from Notice-To-Proceed (NTP).
- B. Refer to Division 01 and General Conditions of the Construction Contract provisions for additional details and requirements.
- C. All substitutions shall meet the performance requirements specified at a lower cost to the Owner than the products specified.
- D. The SES shall submit all data necessary to prove that the substitute products meet the performance requirements shown on the Contract Documents.
- E. The SES shall submit all requests for substitutions to identify the following:

1. Specification section, paragraph, model and manufacturer of the product specified.
2. Suggested substitute including model and manufacturer and each component required, including quantities.
3. Credit to the Owner.
4. Complete product data, including cut sheets, manufacturer specifications, application diagrams, and installation details.
5. Description of the reason why, in the SES's opinion, substitution is recommended. Description and details for installation of the substitute product as specifically required for this project.
6. Technical description of equivalent performance and any deficiencies.

## 2.2 MANUFACTURED PRODUCTS

- A. Materials and equipment provided shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.
- B. The products specified were the latest generation available by the manufacturer at the time of specification. These products provide the minimum functionality and intent of the systems requirements. The Contractor shall provide, at the time of submittal, the manufacturer's latest generation of that product, both hardware and software, with equal or greater functionality as what was specified. All equipment shall bear labels attesting to Underwriters Laboratories listing where subject to Underwriters Laboratories label service. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of five (5) years.
- C. NEMA Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance, as delineated in schedules and in the specifications, shall be interpreted as minimum performance.
- D. When more than one unit of the same type of equipment or material is required, such units shall be the products of a single manufacturer.
- E. Equipment Assemblies and Components:
  1. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Design Professional and Owner.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.
  5. Moving parts of any element of equipment of the unit normally requiring lubrication, shall have means provided for such lubrication, and shall be adequately lubricated at the factory prior to delivery.

- F. All factory and field wiring shall be identified on the equipment being furnished and on all wiring diagrams.

### 2.3 CABLING AND WIRING REQUIREMENTS

- A. Provide color-coded cable jackets for identification in cable trays, junction boxes, conduit, and back boxes. Coordinate with Div. 26 EC for conduit and junction box painting or color coding. Refer to the Division 27 Structured Cabling System Specifications for required cable jacket color coding.
- B. All concealed in finished walls security cabling including communications, video surveillance, and intrusion detection shall be in conduit. All cabling concealed above finished accessible ceiling shall be open cabling. Provide cabling supports as required for a clean and workmanlike installation. No cables shall be run exposed. The SES Contractor shall coordinate all infrastructure requirements with the Electrical Contractor.
- C. Do not run low voltage, signal, or control wiring in same conduit/conduit/raceway as electric power cables. Cables for door locks above 48 volts are power cables. Provide separation from lighting fixtures and other electrical appurtenances. Provide electrical interference protection circuits as required to maintain the specified signal quality and as required by system manufacturers.
- D. Use separate junction boxes and enclosures for individual low voltage systems cabling. Junction boxes and conduit shall be color coded for identification of the internal system cabling.
- E. Cable management support systems shall be segregated between low voltage systems cabling and power cabling. Cables shall be colored to identify within the cable management system the identity of the low voltage system. This color shall match the associated conduits and junction boxes used for the same systems.
- F. Provide and maintain pull strings / tapes / ropes in all conduits for future installation of additional cabling.
- G. Submit a wire-marking scheme to uniquely identify each wire in the system.
- H. Provide multi-conductor cables with all conductors marked. Multiple pair cable shall have each pair marked.
- I. Provide cable marking at each panel, at each device, and at any junction box.
- J. Provide cable-labeling system as specified in this Section.
- K. Provide markers to indicate zone number, circuit number, or similar.
- L. Provide a wiring legend to indicate wire marking code definitions. This chart shall identify each and every wire in the system.
- M. All wire colors, markings, legends, zones, circuit numbers, and identifications shall be provided in the as-built documentation.
- N. Provide cabling as described in each Section for each system/device.

2.4 WIREWAY WIRE MANAGEMENT

- A. Coordinate the cable requirements for proper size and loading requirements of the wireway system.
- B. Enter and exit any wireway system per Division 26 specifications, using standard wiring, safety and workmanship standards. Refer to Contract Drawings and conduit requirements for more information.
- C. Install color-coded systems wire within any wireway system for easy identification.

2.5 CONDUIT WIRE MANAGEMENT

- A. The Division 26 Electrical Contractor (EC) shall provide the primary conduit system located in the building. The SES Contractor shall refer to the Division 26 drawings and coordinate with the Electrical Contractor.
- B. The SES Contractor shall provide all ancillary conduits as required, unless provided by the EC. The SES Contractor shall refer to the Division 26 EC specifications for conduit specifications and provide similar type for ancillary runs.
- C. The SES Contractor shall coordinate the security cable requirements with the EC for proper size and fill requirements of the conduit system prior to purchase or installation.
- D. The SES Contractor is required to color code conduit system for easy identification of system contained within. When using J-hooks or open cabling management, use color coded Velcro straps to identify each system's cabling.
- E. The SES Contractor is required to install firestop around any conduit passing through fire partitions, firewalls and floors. Refer to specification this Section.
- F. The SES Contractor is required to install pull strings into every conduit in which they install cable.

2.6 CABLE AND WIRE LABELING

- A. Provide heat shrink type, scratch resistant, oil resistant, smear resistant, indelible labeling through Portable Computerized Labeling System.
- B. All cables and individual wiring shall be uniquely labeled with indelible markings which remain intelligible when and after contact with water and oil. All cables shall be labeled at all connection points, junction, pull boxes, server rooms / MDF's, IDF's, and wiring closets. All individual wires shall be labeled where accessible in cabinets, junction boxes, and pull boxes.
- C. The Contractor shall fully inform themselves of the Owner's cable labeling standards prior to the start of work. The Contractor shall re label any or all cabling until the Owner is satisfied, at no additional cost to the Owner.
- D. Refer to specifications section 271000 for detailed Category-6A labeling standards and requirements.

- E. Cabling and wiring logs shall be maintained for all cabinets, junction boxes, and pull boxes. The cabling log shall identify all accessible cabling whether connected or passing through. Refer to systems specifications for additional requirements.
- F. Provide labeling through a computerized permanent labeling system such as Panduit, Bradley, or Brother.
- G. Provide landing and termination schedules that clearly identify all wire runs matching the infrastructure shop drawings. These shall become the Owner's as-built records which shall be provided by the SES for establishing final payment.

## 2.7 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the National Electrical Code, install an identification sign which will clearly indicate information required for use and maintenance of items such as cabinets, control devices and other significant equipment.
- B. Nameplates shall be laminated white phenolic resin with a black core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions. Affix with rivets or other approved fasteners. Glue, tape or cement is not approved.
- C. Upper case letters of uniform height; centered on device, coverplate, or enclosure; engraved letters filled with a contrasting color; and all characters made clearly and distinctly.
- D. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling unless indicated otherwise.

## 2.8 SECURITY EQUIPMENT POWER

- A. All security equipment shall be backed up by battery backup or Uninterruptible Power Supplies (UPS).
- B. The Contractor shall coordinate with the EC to provide electric power distribution from the power distribution panels to all security equipment.
- C. UPS units powering rack equipment shall be rack-mounted and provide clean backup power for the equipment mounted in the rack.
- D. Refer to item 2.11D below for additional details and requirements.

## 2.9 FIRE STOPPING

- A. Provide code-required fire stopping at all fire rated wall, floor, and partition penetrations with UL listed fire stopping materials. All penetrations of fire-resistance-rated construction shall be protected using listed and approved through-penetration firestop assemblies. Refer to specifications in this Division as well as the specifications of Division 26 and Division 07 – in particular section 078413 Firestops and Smoke-seals.

2.10 SURGE PROTECTION FOR EXTERIOR WIRING

- A. Provide surge protection at/with the terminal boards and connectors for each security copper wire entering or exiting the building.
- B. Provide Building Entrance Terminals indoors in equipment rooms at the point of cable entrance or exit from the building.
- C. Building Entrance Terminals (BET) shall be comprised of a heavy duty, premium quality cabinet with a cover, wall or frame mounted, cable raceway, internal splice chambers, cable connection or punch down, and surge protection modules.
- D. Provide appropriate type connectors for cables.
- E. BET shall be equipped with an internal fuse link and external ground connectors.
- F. BET shall meet or exceed UL497.
- G. Refer to Section 271000 Structured Cabling System for additional details and requirements for Cat-6a cables.
- H. Manufacturers: Subject to compliance with requirements, provide products by Circa Enterprises Inc, Avaya, Siecor, AT&T, Ditek, L-Com, or approved equal.

2.11 SURGE PROTECTION FOR ELECTRONIC EQUIPMENT

- A. Surge/Lightning Protection - All electrical circuits supplying power to security system components furnished under Division 28 Specifications shall be equipped with surge protectors. Any circuits not supplied through the UPS shall have separate surge protectors. These surge protectors shall be furnished and installed by the Division 28 Security Contractor. It shall be the responsibility of the SES Contractor to coordinate installation and to verify that protectors are installed properly. Division 26 shall provide and install surge protectors on all underground signal circuits.
- B. The surge protection shall meet the following minimum performance requirements:
  - 1. Spike dissipation: 180 Joules.
  - 2. Spike voltage: 6000 V, clamping at 225 V.
  - 3. Spike current: 15000 A.
  - 4. Clamping response time: <5 nanoseconds.
  - 5. Noise rejection frequency range: 150 KHz to 100 MHz.
  - 6. Noise protection: transverse and common modes.
  - 7. Leakage to ground: <10 mA.
- C. The power line conditioners shall provide the number of outlets necessary for all equipment and service outlets required for effective servicing.

- D. Manufacturers: Subject to compliance with requirements, provide products by Leviton, Hubbell, United Power, Furman, SurgeX, APC, or approved equal.

2.12 UNINTERRUPTIBLE POWER SUPPLIES (UPS'S)

- A. Coordinate with the Division 26 Electrical Contractor to provide UPS-backed emergency power for all Security Systems components.

2.13 GROUNDING AND ISOLATION

- A. Provide single point grounding of the individual systems as recommended by IEEE and system manufacturers.
- B. The SES Contractor shall provide in each rack a copper busbar as a ground unipoint for connection of grounding conductors used for the equipment in that rack.
- C. The SES Contractor shall coordinate with the Div. 26 EC to provide connection of each rack's busbar to the ground busbar in the circuit breaker panel using minimum #4 AWG insulated copper conductor.
- D. The SES Contractor shall provide connection of each rack's ground busbar to the rack frame by means of a tightly attached lug and connection shall be made between lug and ground busbar using minimum #12 AWG stranded wire, type TW.
- E. The SES Contractor shall coordinate with the Division 26 work all electrical power, grounding and surge protection as required to meet the provisions of NFPA 70 - National Electric Code, Article 250-146 for isolated ground type installations.
- F. Provide grounding of underground distribution systems as required by National Electric Code. Provide cabling plant ground of maximum 25 ohms, measured in normally dry conditions, not less than 48 hours after a rainfall. Where a 25-ohm reading cannot be obtained, provide additional ground rods connected to the existing rods. Ground rods shall be copper-clad steel, 10 foot x 3/4 inch diameter.
- G. Coordinate grounding requirements with other trades and contractors to preclude closing of ground loops via peripheral equipment supplied from different electrical power sources. Provide isolation transformers and other equipment as required.

2.14 ENVIRONMENT

- A. All equipment shall be installed in accordance with the manufacturers' environmental specifications. The most stringent manufacturers' requirements for any piece of equipment in any location shall be the requirements for the entire room, closet, or enclosure, even if those requirements are greater than those listed in these Specifications.
- B. Coordinate with other trades for the installation of all air conditioning, humidifying, air filtering, and any other room conditioning system required to meet all environmental specifications.
- C. Ambient temperature in all rooms, closets, or enclosures containing communications system equipment shall not exceed 80 degrees Fahrenheit. Coordinate all ventilation and air conditioning required.

- D. Relative humidity in all rooms, closets, or enclosures containing communications systems equipment shall be within the range of 10% to 80% non-condensing. Coordinate all humidifying and dehumidifying equipment required.
- E. All rooms and closets containing communications systems equipment shall have all seals and air filtration systems necessary to maintain manufacturers' restrictions on airborne particulate size and concentration. All enclosures shall be rated for providing the necessary level of protection from airborne particulate and water. Coordinate with other trades to provide all necessary airborne particulate and water minimization equipment and seals.

#### 2.15 ACCESS DOORS

- A. The SES Contractor shall include in the bid all access doors required by codes or local conditions. All access door locations shall be approved by the Architect and Owner.
- B. The minimum access door size acceptable is 12 inches x 12 inches, of clear opening.
- C. The access doors shall meet the requirements listed below:
  - 1. Fire rated as required for each location.
  - 2. Key operated cam lock.
  - 3. Prime-finished, steel construction.
- D. The access doors shall be maximum security, heavy-duty steel doors. Coordinate with the Architect and General Contractor for approved finishes and colors.
- E. Manufactures: Subject to compliance with requirements, provide products by Milco, Gordon, Inc., Armstrong, Acudor, manufacturer matching the Architect's ceiling specifications, or approved equal.

#### 2.16 PLENUM MOUNTED EQUIPMENT/CABLING

- A. All equipment mounted in ceilings that are HVAC plenums shall be rated for such installation or shall be mounted in an enclosure which is listed for plenum use.

#### 2.17 RESPONSIBILITY MATRIX

- A. The Responsibility Matrix indicates the minimum required responsibility of all referenced parties. Lack of a specifically noted responsibility on the matrix shall not relieve the Contractors from the responsibility to provide complete and fully functional infrastructure. In cases where there are multiple parties responsible for a particular item, it shall be the responsibility of the General Contractor to coordinate all efforts until completion has been approved and pre-purchased equipment has been tested by the owner, indicating that the infrastructure is fully functional.
- B. Entity Legend:
  - 1. OWNER – The Owner.
  - 2. CONTRACTOR – The Security Electronic Systems Contractor and their qualified subcontractors meeting the requirements of the specifications.

- C. Abbreviations:

1. ACS – Access Control System
2. IDS – Intrusion Detection System
3. VSS – Video Surveillance System
4. Coord. - coordination

See Responsibility Matrix on the following page.

<b><u>Item</u></b>	<b><u>Furnish</u></b>	<b><u>Install</u></b>	<b><u>Configure</u></b>
Security Systems Network Cat-6 and Fiber Optic Cabling – Refer to Division 27	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Systems Network Cat-6 and Fiber Optic Patch Panels – Refer to Division 27	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Systems Network Cat-6 and Fiber Optic Patch Cabling – Refer to Division 27	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Systems Equipment Racks and Accessories – Refer to Division 27	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Uninterruptible Power Supplies (UPS's) – Refer to Division 26	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Systems Infrastructure, Cable Supports, Raceways, and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Systems Network Switches	OWNER	OWNER	OWNER
ACS Card Readers, IDS Motion Sensors, Cabling, Control Boards, Communications Modules, Power Supplies, Infrastructure, and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
ACS and IDS Monitoring Workstations	CONTRACTOR	CONTRACTOR	CONTRACTOR
Security Intercom Substations, Video Intercom Substations, Master Video Intercoms, Cabling, Infrastructure, and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
VSS Cameras and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
VSS Servers, Software, and Accessories	CONTRACTOR	CONTRACTOR	CONTRACTOR
VSS Monitoring Workstations	CONTRACTOR	CONTRACTOR	CONTRACTOR

**PART 3 - EXECUTION**

**3.1 INSPECTION AND PREPARATION OF WORK**

- A. Prior to any work, the SES Contractor shall coordinate and carefully inspect the installed work of all other trades and verify that all such work is complete to the point where his installation may properly commence or enact modifications that must be made by other trades to accommodate the installation with no additional costs to the Owner.

- B. Verify and certify to the Design Professional/Owner that all equipment may be installed in accordance with all pertinent codes and regulations, the contract drawings and specifications and the referenced standards.
- C. Return to original condition any paved areas, sidewalks, planting, etc., disturbed during system installation.

### 3.2 INSTALLATION

- A. Install all equipment in accordance with the manufacturer's recommendation.
- B. Secure equipment using fasteners suitable for the use, materials, and loads encountered. All exposed hardware shall be tamperproof. Submit evidence providing suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
- C. Equipment location shall be as close as possible to locations shown on contract drawings. Coordinate locations of devices with other trades. The SES shall provide wall, console, furniture, millwork mounted or ceiling mounted devices as directed by the Design Professional with no additional cost to the Owner.
- D. Working spaces shall be at minimum as specified in the National Electrical Code for all voltage specified, but not less than 3 feet.
- E. All equipment shall be installed in location and manner that will allow for convenient access for maintenance and inspection.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.
- G. Routing shall be laid out in advance. The SES Contractor shall develop detailed coordination drawings to identify use of chases, spaces above ceiling and Mechanical / Electrical / Security / Electronic Rooms. The General Contractor shall be advised prior to drilling through structural sections, for determination of proper layout. Routing shall be located so as not to affect structural sections such ribs or beams.
- H. Where conduits, wireways, and other raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight, and completely fill clearances between raceways and openings. Firestop material shall be in accordance with reference codes standards, regulations, and contract documents.
  - 1. Floor, exterior wall and roof seals shall be watertight. Walls and floors which are cored for installation of conduit shall be sleeved with steel tubing, grouted and the space between the conduit and sleeve filled as required by Codes and Standards.
  - 2. Tubing shall extend minimum one (1) inch above finished floor.
- I. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factor of 5, which shall conform with any specific requirements as shown on the drawings or in the specifications.

- J. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage.
- K. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.
- L. Conduits shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.
- M. During construction, cap the top of all conduits and raceway installed vertically.
- N. During installation, equipment shall be protected against entry of foreign matter on the inside; and be vacuum cleaned both inside and outside before testing, operating and painting. Provide painting selected by the Owner.
- O. Damaged equipment, as determined by the Design Professional/Owner, shall be repaired or replaced and returned to operating condition at no additional cost to the Owner.
- P. Painted surfaces shall be protected at all times with protection removed prior to final inspection.
- Q. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

### 3.3 FIELD QUALITY CONTROL

- A. Adjusting, testing and cleaning
  - 1. Substantial Completion requirements are as follows:
    - a. All systems shall be completed and operational, and all controls shall be set and calibrated at SUBSTANTIAL COMPLETION.
    - b. All testing, start-up and cleaning work shall be complete at SUBSTANTIAL COMPLETION.
    - c. All requested modifications to software, Graphical User Interfaces, VSS, intercom/paging and duress system have been completed.
  - 2. All bright metal or plated work shall be thoroughly polished. All temporarily pasted labels (except warning/ID labels), dirt and stains shall be removed from the devices.
  - 3. All testing shall conform to all of the requirements as set forth under Section 280510, Special Requirements.
  - 4. Clean all equipment, construction debris and dust, etc. and leave all equipment in a “like new” condition. Proper precautions shall be in effect to protect dimmer packs, control consoles, and all electronic devices and equipment from airborne particles. In the event particles have entered the mechanisms, a “professional” cleaning of the equipment shall be provided at no cost to the Owner with proof required.

3.4 SYSTEMS CERTIFICATION

- A. The Contractor shall be responsible for Total Quality Control Management for all work provided. Provide certification of the following in regards to the systems:
1. The SES shall inspect, test and adjust systems as required to meet the operational, performance and reliability requirements. When all systems are operating as specified, the Contractor shall schedule and organize joint testing with the Design Professional and Owner.
  2. The SES shall provide joint testing and certification with the Owner designated inspection firm, Local Authorities Having Jurisdiction and Design Professional.
  3. The SES shall submit complete Certifications and test results. Refer to Certification Forms included with the Contract Documents.
  4. The Contractor shall provide a separate certification for each system.
  5. The system certification shall attest that the system provided under this Contract. meets the operational criteria established by the Contract Documents and the requirement of codes, standards, and regulations applicable for the system.
  6. A manufacturer's representative shall be present during each System Testing and Certification.
- B. After all final tests and adjustments have been completed and approved by the Design Professional/Owner, a competent employee of the SES shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Make available as required, qualified personnel to assist in operations of all equipment for a period of 30 days to assure that Owner's Representatives are qualified to take over operation and maintenance procedures. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Manufacturer's representative shall conduct training on specialized electronic systems as described in Division 28.
- C. The SES Contractor shall submit separate recommended INSPECTION, TESTING AND PREVENTIVE MAINTENANCE PROCEDURES for each system.

3.5 SUBSTANTIAL COMPLETION

- A. Schedule Substantial Completion visit with the Owner and Design Professional at a mutually agreed time. Contractor shall notify the Owner and Design Professional a minimum of two (2) weeks in advance of the intended substantial completion inspection time.
- B. Should any part of a system fail during the substantial completion tests to perform according to the Contract Documents, the entire system shall be retested at an Owner selected time and date.
- C. Correct deficiencies unacceptable to the Owner and provide a complete and functional system.
- D. Record and submit to the Owner the final test results as specified herein.
- E. Acceptance: Systems will not be accepted by the Owner until deficiencies have been corrected.
- F. Beneficial use of systems by Owner shall not be considered as an acceptance.

- G. Should additional expense occur to the Design Professional due to repeated reviews, such expense shall be reimbursable to the Design Professional from the Contractor. This shall not be construed as a penalty but as additional project related time because the Contractor's failure to correct the work properly has made the additional review(s) necessary. In the event of such additional expenses, the Design Professional will furnish evidence of such expenses to the Contractor.

### 3.6 WARRANTY

- A. All work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the work of all other Trades resulting from same, shall be replaced or repaired as directed by the Owner's representative.
- B. The SES shall provide to the Owner a written guarantee that the installation, including controls and all other equipment covered under each section of the specifications, performs in an efficient and satisfactory manner.
- C. The SES shall warranty all phases of the system including, but not limited to, software, hardware, peripheral equipment for a period of two (2) years from the date of written final acceptance against defective materials, design, and workmanship.
- D. The warranty period shall commence upon signed final acceptance by the Owner. Beneficial use of any areas or associated components by the Owner shall not be considered acceptance. The Contractor shall be fully responsible for the condition of the work and the safeguard of associated components from the start of work up to signed final acceptance. The Contractor shall correct any issues or deficiencies found at no additional cost to the Owner unless the Contractor can provide clear, documented proof that work was correctly and completely installed but was subsequently damaged or otherwise negatively impacted by a direct action of a member of the public or Owner staff member.
- E. Acceptance tests and procedures shall be developed by the SES and accepted by the Architect & Design Professional/Owner.
- F. The SES shall include all preventive maintenance, parts, and servicing required for the systems provided under Division 28 to be continuously operational. The SES shall provide all preventive maintenance work necessary to maintain the systems in continuous operation through the warranty period. The SES shall provide all parts required for warranty service, in addition to any spare parts specified in other specification Sections which are intended to be used by the Owner for non-warranty servicing. Upon receipt of notice from the Owner of failure of any part of the warranted system, the SES, with the assistance of the supplier, shall promptly replace or repair the defective component to restore an acceptable system at no cost to the Owner.
- G. During the warranty period, there shall be no charges to the Owner for service calls including mileage, labor, travel, expense, etc. for warranty work. The SES shall submit itemized warranty costs for each year. The costs associated with warranties provided by the SES shall be paid to the SES with the construction costs. The SES shall submit costs and documentation required for Owner's budget planning and contract management.

### 3.7 MAINTENANCE AND SERVICE:

- A. This service shall consist of supplier's factory trained representative providing the following:
  - 1. Personnel factory trained by the manufacturers of the system's components.

2. Authorized representative of the manufacturer and have an agreement of factory support.
  3. Provide on-site inventory of spare parts to support the "Systems Response Requirement" listed below. Spare parts to be stored at the facility. Spare parts shall remain the property of the Owner after expiration of the manufacturer's service period.
  4. Five (5) years experience minimum servicing systems of the type included in this project.
  5. Capability of making additions or changes to the software systems used in this project.
  6. Capability of servicing the individual system components and the total integrated system.
  7. All test equipment.
- B. Service Requirements - Guarantee service response requirements shall include the following:
1. 24-hour telephone number.
  2. Service organization shall have a telephone response time of not more than two (2) hours, a site response time of not more than 24 hours, and shall be able to restore the system to service within 48 hours after being notified. This service shall be on a 12-hour per day basis every day of the year, including weekends and holidays.
  3. Shall maintain current set of system documentation including but not limited to the following:
    - a. Wiring diagrams, system diagrams and schematics.
    - b. Operation and maintenance manuals.
    - c. Software programs with flow charts or other appropriate troubleshooting documentation.
    - d. Other documentation as required to provide assistance to the Owner's qualified technical representative on the operation and maintenance of the systems.
    - e. All documents shall be made available to the Owner upon request.
    - f. Upon termination of maintenance agreement, all system documents, or copies of such, shall be furnished to the Owner for maintenance continuity.
- C. Provide technical personnel and spare parts conveniently located, to ensure that the Mean Time to Service/Repair (MTTS), of any malfunction/system failure to be maximum 48 hours. MTTS shall be defined as the required time to return the malfunctioning system to normal operations, calculated for any three-month period.
- D. Provide the Inspection and Preventive Maintenance Service specified below with each year of the warranty period:
1. Two (2) routine inspections per year. The Contractor shall provide an inspection plan which ensures that all system components are inspected, adjusted and reconditioned or replaced if necessary at least one (1) time per year.

2. The Contractor shall provide an emergency service plan which guarantees that the systems provided under this contract are completely functional within 48 hours from the time the Owner have placed the service call.
3. The Inspection shall include all parts and labor.
4. The service contract documentation shall include telephone number, name and address of company, department, manager and service personnel assigned for servicing the systems provided under this contract.
5. The Inspection and Preventive Maintenance program shall include the total cost of all services included, terms and conditions of payment.
6. Provide minor changes to software and Graphical User Interface screens to accommodate the Owner changes required for operations, e.g., changes such as icon locations and coloring, room names and numbers, reports and printouts. These change periods shall be coordinated with the Owner during the first year of operations.

### 3.8 CORRECTION OF WORK, FINAL PAYMENT, AND WARRANTY

- A. Final payment shall not relieve the Contractor of responsibility for faulty infrastructure, materials, and workmanship and, unless otherwise specified, the Contractor shall remedy any defects due thereto and pay for any damage to other work resulting therefrom, which shall appear within a period of two (2) years from the date of acceptance.
- B. Include guarantees and warranties by the respective equipment manufacturers, which shall be subject to the terms and time limits defined under this Article of the Specifications. Each completed and accepted system shall be guaranteed by the Contractor.
- C. Guarantees and warranties furnished by Sub-Contractors and/or equipment manufacturers shall be counter-signed by the Contractor for sole responsibility to the Owner.
- D. Manufacturers' equipment guarantees or warranties extending beyond the warranty period described herein shall be transferred to the Owner along with the Contractors' warranties.

END OF SECTION 280500

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**SECTION 280510 – SPECIAL REQUIREMENTS FOR SECURITY SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to the work of this Section. This section is supplementary to Division 1.
- B. Refer to all Contract Drawings and Specifications listed in Section 280500 for additional requirements.
- C. Refer to Divisions 26 and 27 Specifications for coordination information.

1.2 CONSTRUCTION SCHEDULE

- A. Refer to General Conditions and Requirements. Comply with GC requirements to submit a construction schedule, provide to them the information necessary to produce an accurate and obtainable schedule.

1.3 SUBMITTALS

- A. Comply with requirements of Division 01, General Conditions to the Contract, and all Bid Documents requirements.
- B. All Contractors performing work described by the Division 28 specifications shall be required to follow all requirements of specifications sections 280500 and 280510, as well as the specific requirements of each individual Division 28 section which describes the work that they shall perform.
- C. All shop drawings, submittals, catalog cuts, equipment datasheets, calculations, and as-built documentation shall be stamped approved, signed, and dated prior to forwarding to Design Professional. Unsigned documents shall be returned unreviewed for such stamping.
- D. Any delays resulting from inappropriate submissions will be the responsibility of the Contractor.
- E. Submit all documents as outlined in the various Division 28 specifications, including but not limited to the following:
  - 1. Not later than 60 days after Notice to Proceed, or as required by the General Conditions of the Contract or Division 1 specification, submit the following as one complete submittal:
    - a. Contractor and personnel qualifications. Refer to specifications section 280500 item 1.8 for additional details and requirements.
    - b. Shop drawings, product data, bill of materials, riser diagrams, details and point-to-point wiring diagrams. Refer to items 1.4 and 1.5 for additional details and requirements.
    - c. Details of the warranty that shall be provided for all items furnished by the Contractor.

- d. All schedules, test plans and procedures, spare parts lists and requested samples.
2. At least two weeks prior to requesting Substantial Completion Inspection, submit the following as one complete submittal:
  - a. As-Built drawings. Refer to item 1.12 for additional details and requirements.
  - b. Fully completed testing reports showing that all required items are installed, configured, and tested with passing results. Refer to items 1.7, 1.8, 1.9, 1.10, and 1.11 for additional details and requirements.
3. Not later than 30 days after Substantial Completion and prior to requesting Final Completion Inspection, submit the following as one complete submittal:
  - a. Final As-Built drawings. Refer to item 1.12 for additional details and requirements.
  - b. Operation, Programming, and Maintenance Manuals. and all training materials. Refer to items 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, and 1.19 for additional details and requirements.
  - c. Certification and Warranty Documents. Refer to specifications section items 3.4, 3.5, and 3.6 for additional details and requirements.

F. Refer to Table 280510-2 and specific submittals listed in each Division 28 Section.

#### 1.4 PRODUCT DATA MANUAL

- A. Prior to release of any materials, the Contractor shall submit the product data manual together with the shop drawings as required by the project schedule.
- B. The Contractor shall submit acceptable equipment for review by the Design Professional and the Owner. The Contractor shall bear all liability and penalties for damages arising from his failure to submit equipment that meets these specifications, including, but not limited to, any liabilities and penalties for failure to meet construction deadlines.
- C. Divide the manual to include a separate chapter or volume for each specification listed in Division 28. Reference Contract Document identifications for Specifications and Drawings. For hardcopy manuals, provide dividers with labeled tabs. For electronic manuals, provide a table of contents with hyperlinked section titles.
- D. Final determination of compliance with these specifications shall rest with the Design Professional and the Owner, who, at their discretion, may require proof of performance at the cost to the Contractor.
- E. The Product Data Manual shall include items and references listed as follows:
  1. Contractor and assigned personnel qualifications information. Refer to specifications section 280500 item 1.8.
  2. A complete narrative description of the system's operation. This description shall be comprehensive in that it will describe the total functionality operation of all of the systems and sub-systems and relating equipment. The systems description shall be used by the Design Professional for the purpose of evaluating the Contractor's equipment and materials

submission and the Contractor's understanding of the installation, operation, and intent of the systems.

3. Work schedule detailing how the Contractor will meet the contractual obligations on time in coordination with the GC, with other trades, and with the Owner's scheduling.
4. Bill of materials including quantities, manufacturers, model numbers, brief descriptions, and list prices for all products to be used in the project.
5. Manufacturers' data sheets for the specific products that will be used for this Project. On each data sheet, indicate the specific model that will be provided.
6. Calculations, graphs, and tables to show and substantiate required quantities, capacities, runtimes, loads, and similar.
7. References to applicable codes, standards, and regulations.
8. Spare Parts Manual - Submit spare parts manual containing list of recommended spare parts, equipment and materials., including firmware, software and memory chips. The spare parts list shall include all parts that can render a system in one or multiple buildings inoperable as described in Division 28 Specifications and any parts that are not in the service organization's inventory and cannot be delivered to the site within 24 hours. For each item listed, provide the information listed below.
  - a. Manufacturer's name, address, phone number.
  - b. Manufacturer's model, series, version, and GSA number, as applicable.
  - c. Mean time before/between failure (MTBF).
  - d. Number of devices of same type used for this project and number of spare parts recommended to be stored on the site.
  - e. Current approximate delivery time.
  - f. Current list price.
  - g. Product data and description of operation, including list of equivalent parts, if applicable.

#### 1.5 SHOP DRAWINGS

- A. Submit the product data manual together with the shop drawings as required by the project schedule.
- B. The Shop Drawings shall be created and produced by the Contractor using AutoCAD, Revit, or similar industry-standard computer aided drafting (CAD) or building information modeling (BIM) program. Submissions using scanned or copied portions of the Contract Documents shall be rejected without review. The Contractor shall be permitted to utilize the blank Architectural AutoCAD and/or Revit floor plans and ceiling plans if they are released by the Architect for such purposes.
- C. The Shop Drawings shall be produced through a coordinated effort among all trades and shall show required coordination details. Refer to specifications section 280500 for additional details

and requirements for coordination with other trades. The Contractor shall be responsible for any associated costs or delays caused by failure to perform the necessary coordination.

- D. Reference Contract Document identifications for Specifications and Drawings.
- E. In addition to the technical proposal submittal requirement of the General Requirements for Security Systems, all work shall be based on approved Shop Drawings and referenced product data.
- F. The Shop Drawings shall include items and references listed as follows:
  - 1. A drawing index listing each drawing number and title.
  - 2. A symbols and abbreviations sheet defining each symbol and abbreviation used in the shop drawing set. Do not include symbols or abbreviations which will not be used for this project.
  - 3. A master cabling schedule listing manufacturer, model, and brief description for each cable type used in this project.
  - 4. Cable labeling and color-coding schemes definitions.
  - 5. Floor plans and ceiling plans showing each: field device, equipment room, control room, control jurisdiction, and major cable path.
    - a. All field devices shall be shown in their coordinated, dimensioned, intended location. If the typical field device will be provided as per typical installation details, a reference to the associated installation details drawing shall satisfy the dimension requirement.
    - b. Each field device shall be labeled with a unique identifier that indicates the device type and any unique properties, the location of the field device, and the associated equipment room. These unique identifiers shall be used across all drawing types (floor plans, diagrams, details, schedules).
    - c. Each equipment room and control room shall be called out with a reference to a larger scale detail plan - refer to requirements below for details.
    - d. Each major cabling path shall be represented. Include indication of the quantities and types of cables that shall use each main path. Indicate cable support type and penetrations where applicable.
  - 6. Point to point diagrams indicating the required equipment, cabling, and cable labeling.
    - a. Each and every device and piece of equipment shall be individually represented on the single line diagrams - diagrams showing only "typical" connectivity shall not be accepted.
    - b. Lines with appropriate cable/wire label annotations shall be used to show all required connectivity between all devices and pieces of equipment.
    - c. Devices and equipment shall be neatly grouped according to their physical location. For example, all equipment within the main equipment room shall be shown inside of a rectangle labeled to indicate that it represents the main equipment room.

- d. All devices, cables, equipment, enclosures, and rooms shall be clearly labeled.
7. Equipment and termination wiring details including indication of the type of termination for each cable, conductor, and cable shield. Diagrams/details showing termination details which are typical for many similar instances shall be acceptable.
8. Single point grounding diagrams and details indicating ground bus bars, ground lugs, conductors, panels, and grounding rods as applicable.
9. Installation details for each typical device and piece of equipment including dimensions in reference to site and building elements, references for material type, color, and aesthetic integration as required. Include mounts, fasteners, hardware, supports, and sealing as applicable.
10. Control room and equipment room plan layout/configuration details including dimensions, details, and references for color and aesthetic integration. Indicate all equipment, enclosures, consoles, desks, racks, clearances, wireways, cable supports, and penetrations as applicable.
11. All installation details shall reflect ADA requirements regarding height, type of function, accessibility, and other applicable ADA guidelines. As part of the close-out documents, the Contractor shall provide a statement that it has complied with ADA requirements.
12. Calculations, graphs, and tables to show and substantiate required quantities, capacities, runtimes, loads, and similar.

1.6 DEMONSTRATION - HARDWARE AND SOFTWARE

- A. Refer to Division 0 and Division 1 specifications for requirements regarding schedule for submission.
- B. After the approval of the product data and shop drawings, the Contractor shall demonstrate the operation of the Control and Processing hardware and software portion of Security and Communication Systems. The demonstration shall be completed to the satisfaction of the Design Professional and the Owner.
- C. The demonstration shall include at least one input as if received from each of the systems specified, and prompt operator input data to accomplish the proper sequence of operations as indicated in this Section and the Description of Operation for each typical control center and security station. Provide enhancement of software and/or hardware which performs unsuccessfully or does not meet the requirements specified and allow for resubmission until approved by the Owner and Design Professional.
- D. After all corrections have been made, the Contractor shall notify the Design Professional who will recheck the systems for compliance of all items listed.
- E. Submit demonstration procedure for review 30 days prior to the demonstration. Changes as desired by the Design Professional and the Owner shall be incorporated into the demonstration procedures prior to the demonstration.
- F. If the Contractor elects to provide the demonstration at a location other than the project site, the Contractor shall provide travel and accommodations to two (2) Sheriff personnel, two (2) County

personnel and two (2) Design Professional personnel for each review period to the alternate location as approved by the Owner and the Design Professional. The Contractor shall submit proposed dates for approval at minimum three (3) weeks in advance of the first travel day and shall provide coordination of travel arrangements with each party.

- G. Demonstration shall show complete integration of at least one working component of each type of outboard system.

#### 1.7 SYSTEM TEST PROCEDURES

- A. System Tests: Perform tests based on standards for each category of cable. Tests of twisted pair cabling shall be performed with a minimum of a Level III tester and to the specifications for the cable type.
- B. Test procedures shall be developed by the Contractor using the associated standards. The test procedures shall describe the test instruments used, conditions of tests, when tests are scheduled and who will perform each test for all devices, cabling and end-to-end testing of all systems. Test procedures shall be submitted and approved prior to proceeding with tests.
- C. When factory testing is specified, provide the information listed below.
  - 1. The Design Professional shall have the option of witnessing factory tests. The Contractor shall submit for approval the test procedure and notify the Design Professional a minimum of 15 working days prior to the manufacturer making the factory test.
  - 2. Submit two (2) copies of certified test reports containing test data to the Design Professional for approval prior to final inspection and not more than 90 days after completion of tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be responsible for additional expenses.
- D. Manufacturers shall provide factory testing as required.
- E. Provide products that meet the minimum performance and reliability requirements specified for each system and component.
- F. Mean Time Before / Between Failures (MTBF) for each system component shall be minimum 50,000 hours of operation unless specifically indicated otherwise.
- G. Refer to each section within the Division 28 specifications for test procedures which are specific to each subsystem.

#### 1.8 TEST PROCEDURES MANUAL

- A. Perform tests based on manufacturer and industry standards for each device, cable, and piece of equipment as applicable. Tests shall be performed with manufacturer recommended testing equipment and accessories.
- B. Test procedures shall be developed by the Contractor using manufacturer and industry standards. The test procedures shall describe the test instruments used, conditions of tests, when tests are

scheduled and who will perform each test for all devices, cabling, and end-to-end testing of all systems.

- C. Submit for review and approval a System Test Procedure Manual for each system to include the data listed below:
  - 1. Test procedures for partial and total system testing.
  - 2. System adjustment schedule to include all system components that require adjusting.
  - 3. Typical Test Record Forms which will be used for recording test results. Cabling test record forms shall identify each cable consistent with the cabling schedules required.
  
- D. When factory testing is specified, provide the information listed below:
  - 1. The Design Professional shall have the option of witnessing factory tests. The Contractor shall submit for approval the test procedure and notify the Design Professional a minimum of 15 working days prior to the manufacturer's making the factory test.
  - 2. Submit two (2) copies of certified test reports containing test data to the Design Professional for approval prior to final inspection and not more than 30 days after completion of tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be responsible for additional expenses.

#### 1.9 TEST RECORD MANUAL

- A. Submit a System Test Record Manual for each system to include the actual measurement data, as listed below:
  - 1. Approved test procedures and criteria.
  - 2. System adjustment schedule.
  - 3. Test records with actual test results, recorded on approved Test Report Forms.
  - 4. List of test equipment used.
  - 5. List of typical test conditions.
  - 6. Date and time of testing.
  - 7. Name and telephone number of the organization and person who performed the testing.

#### 1.10 SITE TESTS

- A. Include partial, work phase, and end-to-end testing necessary to verify and record on approved Test Record Manual forms the compliance with applicable codes, standards, regulations, manufacturer specifications, and Contract Documents.
  
- B. At a minimum, the site tests shall include:
  - 1. Testing of all assemblies.
  - 2. Testing of individual equipment for each function.

3. Testing of all cabling for shorts, opens, grounds, and visual inspection for physical damage and labeling.
4. Testing of all inputs and outputs and functions.
5. Testing of all system configuration available by programming, switching, or adjusting.

#### 1.11 SYSTEM ACCEPTANCE

- A. Schedule the FINAL ACCEPTANCE TESTS with the Owner and Design Professional at a mutually agreed time. Contractor shall notify the Owner and Design Professional a minimum of 2 weeks in advance of the intended final acceptance time.
- B. Should any part of a system fail during the acceptance tests to perform according to the Contract Documents, the entire system shall be retested at an Owner-selected time and date.
- C. The Contractor shall correct deficiencies unacceptable to the Owner and Design Professional and provide a complete and functional system.
- D. Record and submit to the Owner the final test results as specified herein.
- E. Acceptance: Systems shall not be accepted by the Owner until deficiencies have been corrected.
- F. Beneficial use of systems by Owner shall not be considered as an acceptance.
- G. Should additional expense occur to the Design Professional due to repeated reviews, such expense shall be reimbursable to the Design Professional from the Contractor. This shall not be construed as a penalty, but as additional project related time because the Contractor's failure to correct the work properly has made the additional review(s) necessary. In the event of such additional expenses, the Design Professional will furnish evidence of such expenses to the Contractor.

#### 1.12 AS-BUILT DRAWINGS

- A. The Contractor shall keep his on-site blueprints up to date at all times. All wiring shall be marked and indexed for permanent record and submitted with as-builts.
- B. When field work has been completed, and before final inspection, deliver to the Owner's Representative a complete set of prints, marked in colored marker, to show all changes made in the drawings so as to indicate the work as-built. Include dimensions from reference points for any concealed work (junction boxes, etc.) requiring future access.
- C. The Contractor shall provide the Design Professional with the as-built drawings in electronic PDF and AutoCAD or Revit formats. The electronic AutoCAD or Revit format of the as-built drawings shall provide the same information as provided on the complete set of paper and PDF as-built drawings. The AutoCAD or Revit files shall also include individual device information to include manufacturer and model number for each device associated with each device.
- D. The as-built drawings shall be fully detailed, and shall include the same types of information and level of detail as required for the Shop Drawings. All final as-built conditions shall be documented, included but not limited to the following information:

1. The exact location of each system wire, devices, components, etc., including but not limited to: field devices, control rooms, electrical and equipment rooms and equipment, wire management, conduit, racks, enclosures, junction boxes, terminal splice boxes, UPS, and associated electric panels, circuit numbers, wire numbers, and unused spare and extra cables.
  2. The exact path taken for all related system wiring and/or conduct.
  3. Each sub-system shall be shown in a separate and distinct color. This shall include all devices, outlets, junction boxes, and system wiring for each sub-system.
  4. For each terminal junction splice cabinet or junction box a complete listing of the circuits and circuit numbers. In addition, this listing shall include the devices that are connected to these circuits and their exact location. This shall be shown in a chart type form, for each junction or splice location.
- E. The As-Built Drawings shall include all as-built conditions and information pertinent to this project in AutoCAD format.
- F. The As-Built drawings shall be created and produced by the Contractor – the Bid Documents drawings shall not be used as any part of the as-built drawing set.
- G. Submit hardcopy and electronic format documents as detailed in Division 0 and 1 Specifications. This shall be done prior to final system acceptance by the Design Professional and the Owner.

#### 1.13 SERVICE AND TECHNICAL ASSISTANCE SCHEDULE

- A. Provide a systems servicing schedule in a 1½” binder and PDF that shall include the information described below:
1. Typical Systems Failures: Information that must be known by Owner’s system operating personnel before calling for services. Provide service log for recording all date and time of service calls, type of failure, description of the repairs, time to repair and service person’s name and telephone, date, time when the system was returned to normal operation.
  2. Service and Technical Assistance personnel and phone numbers schedule. The personnel, department representatives shall be those normally assigned by the contractor / servicing company for the type and size of the systems installed under this project.

#### 1.14 OPERATION AND MAINTENANCE MANUALS

- A. Operation and Maintenance, Programming Manuals: Provide a copy of Operation Manuals, Programming Manuals, and Maintenance Manuals to each of the participants to the training. Minimum eight (8) sets of manuals are required. Provide computer files with the contents of the training manuals.
- B. Training sessions shall contain all information necessary for correct and effective operation, maintenance, testing, adjusting, and programming of each system component.
- C. Effective Training Periods. Preparation, set-up, and testing times shall be included in addition to the minimum training sessions.

- D. Typical training sessions shall be 2 hours for operation and 2 hours for programming. See Training Schedule in Table 280510-1 in this specifications section for the quantities and durations of sessions to be provided for each topic.

#### 1.15 TRAINING

- A. Provide training of Owner's selected representatives for operation, maintenance, and programming.
- B. Operation and Maintenance, Programming Manuals: Provide a copy of Operation Manuals, Programming Manuals and Maintenance Manuals to each of the participants to the training. Minimum eight (8) sets of manuals are required. Provide computer files with the contents of the training manuals.
- C. Training sessions shall contain all information necessary for correct and effective operation, maintenance, testing, adjusting, and programming of each system component.
- D. Effective Training Periods. Preparation, set-up, and testing times shall be included in addition to the minimum training sessions.
- E. Typical training sessions shall be 2 hours for operation and 2 hours for programming. See Training Schedule in Table 280510-2 in this specifications section for the quantities and durations of sessions to be provided for each topic.

#### 1.16 TRAINING FOR SYSTEM OPERATION

- A. Relate the operation training to the contents of the Operation Manuals, described herein.
- B. The Operation Manuals shall contain:
  - 1. Sequences of operation shown on actual graphic representation of the signals and controls provided.
  - 2. Operation Flow Charts (OFC) and descriptions - Provide typical one page flow charts for operation and troubleshooting in a format that is ready for framing.
  - 3. List of information the System Operator have to gather and log in the service log, before calling for service or technical assistance.
  - 4. List of contractor and manufacturers authorized service and technical assistance representatives, their telephone numbers and normal business schedule.

#### 1.17 TRAINING FOR PROGRAMMING

- A. Relate the contents of the training sessions for programming to the contents of the Programming Manuals. Provide minimum eight (8) Programming Manuals for the systems listed.
- B. The Programming Manuals shall include:
  - 1. Control workstations, Graphics User Interfaces, and Control Keypads, typical task-oriented flow charts. As a minimum the following tasks are required: data entry, configuration, review, report generation, diagnostics, start-up.

2. Program troubleshooting flow charts - Provide typical one page flow charts for testing, programming, and troubleshooting in a format that is ready for framing.
3. List of information the system programmer is required to document before service or technical assistance calls.
4. List of contractor and manufacturer authorized service and technical assistance representatives, their telephone numbers and normal business schedule.
5. List of Firmware and Software versions available for the system provided for this Project, description of the various characteristics of the firmware and software in terms of benefits to the end user.
6. System upgrading characteristics and relocation information including hardware implications.
7. TRAINING FOR SYSTEM MAINTENANCE

1.18 TRAINING FOR SYSTEM MAINTENANCE

- A. Relate the maintenance training to the contents of the Operation and Maintenance Manuals, described herein.
- B. The Maintenance Manuals shall contain:
  1. Testing and Adjusting Flow Charts, and descriptions.
  2. Troubleshooting Flow Charts, and descriptions - Provide typical one page flow charts for testing and troubleshooting in a format that is ready for framing.
  3. Service and technical assistance schedule - Provide a system servicing schedule that shall include the information described below:
    - a. Typical System Failures: Information that must be known and entered into the service log by the Owner's system operating personnel before calling for services. Provide service log for recording all date and time of service calls, type of failure, description of the repairs, time to repair and service person's name and telephone, date, time when the system was returned to normal operation.
    - b. Schedule of contractor and manufacturers' authorized service and technical assistance personnel with associated phone numbers and business schedules. The personnel, department representatives shall be those normally assigned by the contractor/system servicing company for the type and size of the systems installed under this project.
  4. Spare parts schedule, with recommended spare parts list for the type, size and complexity of the system provided under this project.
  5. Product data.
    - a. System Record Manual shall include as-built / final information and data for the products used for the Project. Structure this manual similar to the Product Data Manual including separate chapters for Spare Parts and Equivalent Products.
  6. System Record Drawings.

1.19 TRAINING VIDEO DVDS

- A. Provide Training Video DVDs in standard format. Provide digital video files in AVI format for all training videos. Provide separate video DVDs with all training required for operation, programming and maintenance of the systems provided under this contract. The training DVDs shall closely follow the content of the training manuals and the on-site training provided. The video training DVDs shall include titling for each operation, programming and maintenance function. Contractor shall ensure that the video recording equipment is synchronized with all project video sources to avoid shadowing and blanking. At the minimum the training video DVDs shall include the information listed below:
1. The Operation video training DVDs shall include all relevant information for operation of all devices provided. The training shall address interpretation of each signal, required operator actions, the sequence of operator actions, all operator follow up and reporting functions shown on graphical user's guide. Provide detailed demonstration of back-up, restoral procedures, emergency operations including power failures, partial and system failures. Refer to Operator Manual specifications, for additional requirements.
  2. The Programming video training DVDs shall include all relevant information for programming of all devices provided. Provide interpretation of error messages and required debugging. Refer to Programming Manual specifications for additional requirements.
  3. The Maintenance video training DVDs shall include testing, diagnostics, interpretation of results and inspection procedures. Provide detailed preventive maintenance procedures demonstrated through visual inspection, testing, cleaning, replacement and reconditioning of parts.

1.20 SOFTWARE AND ARTWORK SAFEKEEPING

- A. At SUBSTANTIAL COMPLETION, and min. 4 weeks before FINAL ACCEPTANCE, the SES shall deliver to the Owner, under signature, the following Software and Original Artwork:
1. All Standard Operating/Application Software used for this project.
  2. Original software and software descriptions and manuals for all Security Systems.
  3. All Custom Operating/Application Software Source Code and required compilers specifically developed for this project.
  4. All Diagnostic Software Source Code and Reporting facilities.
  5. Complete software database and database printout for all special systems software and databases on removable hard disk or compact disks as applicable as of date of acceptance of the Special Systems by the Contracting Officer. All software shall be labeled with manufacturer's name and software version number. All custom software shall be appropriately labeled. All software shall be accompanied by a user's manual. A complete database printout shall be attached to the user's manual.
  6. All original artwork for graphical user interfaces in AutoCAD/BIM/Revit file format or other open-standards-based, well-known file format.
  7. Hard copy of all software and artwork delivered as described above.
  8. User Instruction Manuals for all software and systems.

9. One (1) spare, ready to use touchscreen monitor for the Control Console.

B. At final acceptance, the SES shall deliver AS-BUILT/RECORD drawings and details.

#### 1.21 SPECIAL TOOLS, EQUIPMENT AND MATERIALS

A. Deliver to the Owners representative all special tools, equipment and materials necessary to maintain the system provided under this Contract. A list of all special tools, equipment and materials associated with each system shall be submitted to the Owner minimum 2 weeks prior to final acceptance test.

B. All electrical work documented on drawings or required under the specifications shall be provided in its entirety.

C. Electrical specifications appearing in other Divisions of this set of Contract Documents shall be considered a part of this specification and shall be enforced as if fully described within these special requirements. The specifications for materials and installation of electrical/electronic components specified within Division 08 and Division 28 shall supersede those of any other section.

### PART 2 - PRODUCTS

2.1 (NOT USED)

### PART 3 - EXECUTION

#### 3.1 ADJUSTING OF SYSTEMS

A. All systems components shall be adjusted for optimum performance under the local conditions particular to the project. The Contractor shall be responsible at no charge to the Owner to readjust all systems to the Owner's satisfaction after the equipment has been in service for 90 days.

#### 3.2 SYSTEMS CERTIFICATION

A. The Contractor shall be responsible for Total Quality Control Management for all work provided. Provide certification of the following in regards to the systems:

1. The Contractor shall inspect, test, and adjust systems as required to meet the operational, performance, and reliability requirements. When system is operating as specified, the Contractor shall schedule and organize joint testing with Design Professional and Owner.

2. The Contractor shall provide joint testing and certification with the Owner designated inspection firm, Local Authorities Having Jurisdiction, and Design Professional.

3. The Contractor shall submit complete Certifications and test results. Refer to Certification Forms included with the Contract Documents.

4. The Contractor shall provide a separate certification for each system.

5. The systems certification shall attest that the systems provided meet the operational criteria established by the Contract Documents and the requirement of codes, standards and regulations applicable for the systems using the systems.

6. A manufacturer's representative shall be present during each systems testing and certification.

- B. After all final tests and adjustments have been completed and approved by the Design Professional/Owner, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for the equipment furnished by the Contractor. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Manufacturer's representative shall conduct training on specialized electronic systems as described herein.
- C. The Contractor shall submit separate recommended INSPECTION, TESTING AND PREVENTIVE MAINTENANCE PROCEDURES for each system.

### 3.3 SYSTEMS ACCEPTANCE

- A. Schedule the FINAL ACCEPTANCE TESTS with the Owner and Design Professional at a mutually agreed time. Contractor shall notify the Owner and Design Professional a minimum of two (2) weeks in advance of the intended final acceptance time.
- B. Should any part of a system fail during the acceptance tests to perform according to the Contract Documents the entire system shall be retested at an Owner selected time and date.
- C. Correct deficiencies unacceptable to the Owner and provide a complete and functional system.
- D. Record and submit to the Owner the final test results as specified herein.
- E. Acceptance: Systems will not be accepted by the Owner until deficiencies have been corrected.
- F. Beneficial use of systems by Owner will not be considered as an acceptance.
- G. Should additional expense occur to the Design Professional due to repeated reviews, such expense shall be reimbursable to the Design Professional from the Contractor. This shall not be construed as a penalty but as additional project related time because the Contractor's failure to correct the work properly has made the additional review(s) necessary. In the event of such additional expenses, the Design Professional will furnish evidence of such expenses to the Contractor.

### 3.4 WARRANTY

- A. Refer to Section 280500 for Warranty requirements.

### 3.5 SYSTEMS MAINTENANCE AND SERVICE

- A. Refer to Section 280500 for Maintenance and Service requirements.

### 3.6 CORRECTION OF WORK, FINAL PAYMENT, AND WARRANTY

- A. Refer to Section 280500 for requirements.

3.7 TABLE 280510-1 - TRAINING SCHEDULE

- A. The Contractor in coordination with the system manufacturers shall provide Training Operation, Programming and Maintenance for each system specified in Division 28 as shown on the Training Schedule included in this Section. The system training and training manuals shall be specifically for the systems provided under this project.
- B. Refer to training schedule on next page:

Specification Sections	Description	Sessions	Time Each (Hours)	Comments/ Reference Section
281300	ACCESS CONTROL AND INTRUSION DETECTION SYSTEM			
	• Operation	2	2	
	• Programming	1	2	
	• Maintenance	1	2	
281523	SECURITY INTERCOM SYSTEM			
	• Operation	6	1	
	• Programming	1	2	
	• Maintenance	1	2	
282000	VIDEO SURVEILLANCE			
	• Operation	2	2	
	• Programming	1	2	
	• Maintenance	1	2	

3.8 TABLE 280510-2 - SUBMITTAL REGISTER

- A. The Contractor shall submit coordinated drawings, manuals and test results for "EACH" system specified under Division 28. Refer to individual system specification sections. All submittals shall be stamped-approved by Contractor, signed and dated prior to review. Unsigned materials shall be returned for such approval.
- B. Refer to the Submittal Register on the next page:

Description	Submit For			Submit As Part Of		Comments / Reference Sections
	Review	Approval by Owner &/or Design Professional	Records	Shop Dwgs & Product Data	As-Built Dwgs & O&M Manuals	
Special Systems Qualifications	X	X	X	X		280500
Performance Bonds	X		X	X		280500
Product Data	X	X	X	X	X	Item 1.4
Shop Drawings	X	X	X	X		Item 1.5
Demonstration Procedures	X	X		X		Item 1.6
Demonstration	X	X		X		Item 1.6
Test Procedures Manual	X	X		X	X	Item 1.8
Test Record Manual	X	X	X	X	X	Item 1.9
As-Built Drawings	X		X		X	Item 1.12
Systems Service & Technical Assistance Schedule	X		X		X	Item 1.13
System Operation and Maintenance Manuals	X		X		X	Item 1.14
System Training DVDs	X		X		X	Item 1.19
System Certification	X	X	X		X	Items 3.2, 3.9
Software, Source Code and Art Work	X		X		X	Item 1.20
Guarantee Certificates	X		X		X	Next page

3.9 SYSTEMS CERTIFICATION FORMS

- A. Refer to the sample Systems Certification Forms on the next page:

Company Letterhead:

Date: \_\_\_\_\_

### Video Surveillance System

We \_\_\_\_\_ certify that the Video Surveillance System provided under contract \_\_\_\_\_ is fully operational and meets all requirements of applicable codes, standards, regulations and contract documents as indicated on this certification test report.

*Notes:*

1. All responses shall be based on inspection, testing and adjusting performed on the date shown above for this certification.
2. The company issuing the certification shall clearly identify/indicate all differences and exceptions from features, functions shown on Contract Documents.
3. A copy of this certification and Inspection, Testing, Adjusting and Maintenance requirements shall be maintained at the Owner's file and Contractor's file.

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#### Part I General

- 1.1 Project Name: \_\_\_\_\_ Location: \_\_\_\_\_  
Project Numbers: \_\_\_\_\_
- 1.2 Applicable Codes, Standards and Regulations (List):
- 1.3 Manufacturer Instructions (List):
- 1.4 Applicable Contract Documents (List Drawings, Specs, Addendums, Bulletins):
- 1.5 Test Reports Are Located: \_\_\_\_\_  
The final/acceptance tests were witnessed through:  
 Authority having jurisdiction, represented by: \_\_\_\_\_  
 Owner, represented by: \_\_\_\_\_
- 1.6 As-Built/Record Drawings are located: \_\_\_\_\_
- 1.7 Operating and Maintenance Manuals, Product Data are located: \_\_\_\_\_

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Signature

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Date

Company Letterhead:

Date: \_\_\_\_\_

### Access Control and Intrusion Detection System

We \_\_\_\_\_ certify that the Access Control and Intrusion Detection System provided under contract \_\_\_\_\_ is fully operational and meets all requirements of applicable codes, standards, regulations and contract documents as indicated on this certification test report.

*Notes:*

1. All responses shall be based on inspection, testing and adjusting performed on the date shown above for this certification.
2. The company issuing the certification shall clearly identify/indicate all differences and exceptions from features, functions shown on Contract Documents.
3. A copy of this certification and Inspection, Testing, Adjusting and Maintenance requirements shall be maintained at the Owner's file and Contractor's file.

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#### Part I General

- 1.1 Project Name: \_\_\_\_\_ Location: \_\_\_\_\_  
Project Numbers: \_\_\_\_\_
- 1.2 Applicable Codes, Standards and Regulations (List):
- 1.3 Manufacturer Instructions (List):
- 1.4 Applicable Contract Documents (List Drawings, Specs, Addendums, Bulletins):
- 1.5 Test Reports Are Located: \_\_\_\_\_  
The final/acceptance tests were witnessed through:  
 Authority having jurisdiction, represented by: \_\_\_\_\_  
 Owner, represented by: \_\_\_\_\_
- 1.6 As-Built/Record Drawings are located: \_\_\_\_\_
- 1.7 Operating and Maintenance Manuals, Product Data are located: \_\_\_\_\_

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Signature

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Date

Company Letterhead:

Date: \_\_\_\_\_

**Security Intercom System**

We \_\_\_\_\_ certify that the Security Intercom System provided under contract \_\_\_\_\_ is fully operational and meets all requirements of applicable codes, standards, regulations and contract documents as indicated on this certification test report.

*Notes:*

1. All responses shall be based on inspection, testing and adjusting performed on the date shown above for this certification.
2. The company issuing the certification shall clearly identify/indicate all differences and exceptions from features, functions shown on Contract Documents.
3. A copy of this certification and Inspection, Testing, Adjusting and Maintenance requirements shall be maintained at the Owner's file and Contractor's file.

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**Part I General**

- 1.1 Project Name: \_\_\_\_\_ Location: \_\_\_\_\_  
Project Numbers: \_\_\_\_\_
- 1.2 Applicable Codes, Standards and Regulations (List):
- 1.3 Manufacturer Instructions (List):
- 1.4 Applicable Contract Documents (List Drawings, Specs, Addendums, Bulletins):
- 1.5 Test Reports Are Located: \_\_\_\_\_  
The final/acceptance tests were witnessed through:  
 Authority having jurisdiction, represented by: \_\_\_\_\_  
 Owner, represented by: \_\_\_\_\_
- 1.6 As-Built/Record Drawings are located: \_\_\_\_\_
- 1.7 Operating and Maintenance Manuals, Product Data are located: \_\_\_\_\_

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Signature

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Date

END OF SECTION 280510

**SECTION 28 13 00 - ACCESS CONTROL AND INTRUSION DETECTION SYSTEM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to requirements of this Section.
- B. Refer to all Contract Drawings and specification sections listed in Section 280500 and 280510 for additional requirements.
- C. Refer to Division 26 and 27 and the Electrical drawings for coordination requirements for power and infrastructure.

1.2 COORDINATION

- A. Work shall be coordinated with all trades having related work on site including but not limited to general, building, structural, civil, site, landscape, mechanical, electrical, fire alarm, fire protection, and HVAC.

1.3 GENERALIZED DESCRIPTION OF WORK

- A. Provide new OSSI Intelli-Site 4 Access Control and Intrusion Detection System (ACS). Provide all programming, connectivity, installation, infrastructure for a complete and integrated Access Control System.
- B. Provide integration with the Owner's existing ACS for centralized management and monitoring.
- C. Integration of the new system shall occur with such devices as described within the Contract Documents to include Video Surveillance Systems, Server/Software, Intercom, and electrified door hardware devices.
- D. Provide new ACS enclosures and power supplies where required by Contract and required by systems installation. New ACS enclosures shall only be installed in the equipment rooms as shown on the Contract Drawings, communicating to the Central Server over a local LAN connection.
- E. Provide new ACS servers for centralized system management, permissions control, logging, and integration. Coordinate with Owner for exact installation location.
- F. Provide new ACS workstations as shown on the Contract Drawings. The Contractor shall provide all required programming and install all new software required.
- G. Provide ACS card readers as shown on the Contract Drawings. Provide new cabling and infrastructure as required for complete connectivity.
- H. Provide new electrified door lock and ACS control board power supplies as required.
- I. Provide Category-6A cabling for all connections to the Security network.

- J. Provide all cabling required for fully functional systems whether or not explicitly called out on the contract documents.

#### 1.4 SYSTEM OPERATION

- A. Control Access to buildings and selected areas using existing proximity cards, card readers, biometric readers, keypads, and electrified locking system and input and output control devices.
  - 1. Selected Exterior Doors: Control access into building at locations as shown within Contract Documents and currently implemented on the existing Access Control System.
  - 2. Selected Interior Doors: Control access into areas as shown within Contract Documents and currently implemented on the existing Access Control System.
- B. Restrict Access of individual cardholders by time of day, day of week and specific points of entry via system software.
- C. Monitor points in buildings and selected areas as shown on drawings that provide unauthorized access or egress and may be a point for forced entry. The system shall report changes in status for all monitored points indicating the specific location so the operator can respond appropriately.
  - 1. Exterior Perimeter and Internal Points: Integrate supervised inputs to system for monitoring the status of doors.
  - 2. Interface with new Request to Exit devices.
  - 3. Interface with new Motion Detectors.
- D. Provide integration with Video Monitoring of doors and alarms when access is requested or a door is opened. This is provided by integration between the Access Control System and Video Surveillance System.
- E. Provide integration with the Video Surveillance System for complete integration of all alarms, troubles, any video monitoring, as well as compliance with the following paragraphs in this section.
- F. Access Control System Workstations shall provide a real-time display of all system events, archive all events in a history file on the hard disk and serve as the instrument through which all system programming is accomplished.
- G. Access Control System Servers shall be installed in location determined by the Owner and shall run the system database service and a user interface for monitoring system activity and database administration. The system server workstation shall have the operating system for the access control software function installed.
- H. Provide monitoring of new monitored and controlled doors as shown within Contract Documents.
- I. Provide computer display of graphic building maps with graphic display of door status and integrated alarms on the Access Control System workstations.
- J. Provide Alarm and Event Routing to allow System Administrators to route alarms and events to various Access Control System workstations located within the facility. The Alarm and Event routing shall provide network synchronization for when an event is monitored by multiple

workstations, once the first workstation acknowledges the alarm/event, it shall be silenced/cleared from other monitoring workstations. Coordinate final programming with Owner.

- K. Provide database setup to allow for full functionality of the new software.
- L. Provide interfacing to Fire Alarm System. Refer to Fire Alarm drawings and Fire Alarm Specifications for additional information. Coordinate with the Fire Alarm Contractor.
- M. Provide cabling, infrastructure, wiring, and panel enclosures for all new devices being installed.
- N. Provide all necessary programming for a fully functional Access Control System.
- O. Provide interface to Video Surveillance System for Video – Follow – Alarm.
- P. Provide report generation for all alarm signals.
- Q. Provide all power supplies for access control equipment and door locks. All access control systems including card readers, computer systems and door lock power supplies shall have battery backup UPS power.

#### 1.5 RELATED WORK

- A. In addition to work described above under DESCRIPTION OF WORK, the work shall include, but not necessarily be limited to, the following:
  - 1. Rigging of equipment and materials including all miscellaneous steel and hangers for support of all installed equipment.
  - 2. Assembly of all equipment furnished disassembled.
  - 3. Testing and start-up of all equipment supplied.
  - 4. Cleaning of all apparatus specified elsewhere.
  - 5. Equipment identification as specified herein and elsewhere.
  - 6. Provide patching and painting to match existing finishes.

#### 1.6 QUALIFICATIONS

- A. The installer shall be factory certified by the Access Control System manufacturer to install and program the Access Control System as described in the Contract Documents.
- B. Refer to Sections 280500 and 280510 for additional qualification details.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Manufacturers:
  - 1. Touch-Screen Capable Access Control System:
    - a. Intelli-Site by OSSI, No approved Equal.
  - 2. Security Management and System Control Hardware

- a. The ACS hardware shall be Compass series Controllers by OSSI, no approved equal.
3. Security Management and Security Control Panels
  - a. OSSI Compass Intelligent Reader Modules (IRMs), no approved equal.
  - b. OSSI Compass Intelligent Input Modules (IIMs), no approved equal.
  - c. OSSI Compass Intelligent Output Modules (IOMs), no approved equal.
4. Card Readers and access cards shall be as manufactured by OSSI or approved equal. Coordinate to match the Owner's existing readers and cards used throughout the County.
5. Power Supplies: shall be as manufactured by OSSI, Altronix, or approved equal.

**B. Systems:**

1. Provide a complete system designed to operate as a single coordinated unit.
2. The interaction time between system input at the touch screen or workstation and the activation of a field device shall not exceed 0.75 second. The interaction time between field input device and display on the touch screen control panel shall not exceed 0.75 second.

**2.2 INTEGRATED SECURITY CONTROL AND MANAGEMENT SYSTEM**

**A. General**

1. This document is intended to specify the general requirements for the materials, labor, documentation, programming, and services necessary to develop/furnish a complete and operational Access Control and Intrusion Detection System (ACS). The specifications herein represent general, minimally-acceptable criteria. Detailed systems descriptions will be developed in-conjunction with the Security Electronics Systems Integrator during the submittal process.

**B. Description**

1. The ACS shall consist of a fully automated computer-based integrated security, control, and management system, including, but not limited to, the following functions and capabilities:
  - a. Automatic alarm/event annunciation, control, and information management functions provided by a single master program.
  - b. Integration with the Video Surveillance System (VSS) and Network Video Recorders (NVRs) to provide automatic camera call-up display on alarm/event monitors or designated others, manual camera call-up display and automatic/manual Video control. Integration with the Video Management System (VMS) to provide automatic video/voice channel call-up display/playback or record on alarm/event monitors, manual channel call-up display/playback or record and automatic/manual Video. Capable of direct IP camera call-up without VSS/DVR/NVR interaction.
  - c. Capable of integration with Fire Alarm Control Panel (FACP) systems to provide secondary alarm notification (display-only) information to the ACS operator.
  - d. Integration with doors for alarm/event annunciation and control.
  - e. Integration with all Intrusion Detection devices to provide automatic alarm/event annunciation and control.

- f. Integration with managed network devices via Simple Network Management Protocol (SNMP).
  - g. Capable of integration with Radio Frequency Identification (RFID) systems to provide automatic control and monitoring of personnel and asset tracking.
  - h. Integration with Master Clock (MC) and network time protocol (NTP) systems to provide system-wide time synchronization.
  - i. Integration with Multi-Purpose/General Purpose Input - Output (MP/GP-IO) systems to provide non-specific input/output control for digital and analog control devices as listed herein.
2. The system equipment and installation shall comply with all provisions and requirements of this specification as well as any and all applicable federal, state, and local codes and standards.

**C. System Components**

1. The basic components of the new ACS shall include:
  - a. The software user interface shall be optionally touch screen and/or mouse driven, utilizing point and click buttons, pop-up menus and user defined graphical icons.
  - b. The ACS shall support optional software modules for access control, video, badge creation, database archive and retrieval, door control, intrusion alarm monitoring, intercom, and fire alarm (secondary annunciation and display only) RFID tracking subsystem integration, automatic report and log function export to security and time-tracking reporting subsystems and other subsystem functions as defined in this specification and other contract documents.
  - c. The ACS server shall communicate with ACS client workstations over an industry standard Ethernet Local Area Network (LAN) or Wide Area Network (WAN).
  - d. The software user interface shall be touch screen, mouse or event driven, utilizing point and click buttons, pop-up menus, text-to-speech (TTS) annunciation, and user-defined graphical icons.
  - e. The ACS shall be capable of supporting a logging printer.
  - f. Integration shall be provided to support all sub-systems as detailed in contract documents.
  - g. Coordinate with the Owner for connection to the Owner's IP network to support LAN communications between the ACS server, all ACS workstations, and all ACS control boards.

**D. System Hardware**

1. ACS Server minimum requirements:
  - a. Provided with 19-inch rack mounted flat panel color monitor with standard 101-key keyboard and two-button mouse. The computer must be compatible with the latest issue of Microsoft Windows.
  - b. Utilize a current generation Intel Core i7 workstation processor or higher, supporting true multi-user, multi-tasking, multi-threaded capabilities with a minimum of 16 GB of RAM or Higher.

- c. Include an internal or USB external 16 bit (minimum) sound device to support audible annunciation of system events and (text-to-speech generated) voice messages. External PC speakers shall support volume control.
  - d. Supplied with two (2) internal removable solid state drives in RAID 1 with a capacity of at least 250-GB each
  - e. Supplied with 1TB SATA secondary drive
  - f. Internal DVD-ROM Drive supporting at least 72X speeds.
  - g. At least four (4) USB ports.
  - h. Utilize a true 64-bit Operating System capable of supporting multi-user, preemptive multi-tasking, multi-threaded operations. Operating system shall be the latest version of Windows 10 Professional or Windows Server Standard as recommended for compatibility with the ACS software.
  - i. Provided with all the application software necessary to support the ACS and report management functions as defined herein in this specification.
  - j. Supplied with a network interface card supporting an industry standard LAN. The system shall be capable of running and supporting the ACS network protocol utilizing at least one (1) network interface card.
  - k. The server shall be provided with a Windows-compatible mass storage media system for archiving purposes. Event transaction data copied and archived to a removable data cartridge shall be capable of being accessed directly from the online operational system. Archive and database query functions shall not affect system performance.
  - l. Provide ACS server as manufactured by Dell, HP, Lenovo, or approved equal.
2. ACS Monitoring and Management Workstations minimum requirements:
- a. The operator workstation shall be provided with a 24" flat panel color monitor with standard 101- keyboard and two-button optical mouse. The computer system shall be the same brand as the ACS server.
  - b. The operator workstation shall utilize a current generation Intel Core i5 desktop processor supporting true multi-user, multi-tasking, multi-threaded capabilities with a minimum of 8 GB of RAM.
  - c. The operator workstation shall be supplied with an internal hard disk drive, capacity of at least 500GB, and an internal CD-ROM drive supporting at least 72X speeds.
  - d. The operator workstation shall include an internal 16 bit minimum sound card or other Windows-compatible USB sound device to support audible annunciation of system events and text-to-speech generated voice messages. External PC speakers shall support volume control.
  - e. The system shall be capable of supporting at least four (4) USB ports. Each operator workstation shall be capable of supporting at least one (1) printer.
  - f. The operator workstation shall utilize Windows 10 Professional with the latest service packs installed.
  - g. The operator workstation shall be supplied with a network interface card supporting an industry standard LAN. The system shall be capable of running and supporting the ACS network protocol utilizing at least one (1) network interface card.



API. The following table lists, at minimum, the various FAS manufacturers that must be supported by the ACS software:

- 4) The integration of Intrusion Detection System (IDS) devices, from various manufacturers, and not be dependent on, or designed specifically for, any one IDS manufacturer's system.
- 5) The integration of Standard Network Management Protocol (SNMP)-capable devices, from various manufacturers, and not be dependent on, or designed specifically for, any one SNMP-capable device manufacturer's system. The method of integration shall be at the device level, utilizing direct-device-communications, via SNMP.
- 6) The integration of Radio Frequency Identification (RFID) systems, from various manufacturers, and not be dependent on, or designed specifically for, any one RFID manufacturer's system. The method of integration shall be at the device level, utilizing direct-device-communications, via either: direct-device protocol, or, API.
- 7) The integration of Master Clock (MC) systems, from various manufacturers, and not be dependent on, or designed specifically for, any one MC manufacturer's system. The method of integration shall be at the device level, utilizing direct-device-communications, via either: direct-device protocol, or, NTP API.
- 8) The Integration of Multi-Purpose/General-Purpose Input/Output (MP/GP-IO) systems, from various manufacturers, and not be dependent on, or designed specifically for, any one MP/GP-IO manufacturer's system. The method of integration shall be at the device level, utilizing direct-device-communications, via either: direct-device protocol, or, API.

G. Graphical User Interface (GUI) Capabilities: The ACS shall fully support all of the GUI capabilities listed and described in the following sections.

1. Screens: The ACS shall allow user interface screens with user defined objects to be created and linked in any order. All screens, screen links and screen functions shall be defined by the system administrator in real time and become active immediately upon definition. Screen definition, including the addition of intelligent, screen-control objects shall be accomplished by graphical, drag-and-drop methods. Text-based "line programming" shall not be used for screen definition. All definitions shall be able to be changed while the system is on-line and operational. The Screen management software shall be a fully-integrated module of the ACS. The screen management software module shall allow a system administrator to define:
  - a. Any sequence of "linked" screens. Navigation buttons, from screen-to-screen, shall be automatically created by simply dragging-and-dropping one screen onto another.
  - b. Any number of Screen lists. The Screen list shall allow the user to automatically create a group of related screens and screen navigation by drag-and-drop of a screen or group of screens. The screen list shall allow the user to display any screen on an automatically-created navigation pad so that the user can select a screen by name and navigate to the selected screen. The screen list shall also allow the user to program screen tours to allow the system to automatically switch from one screen to another with user-adjustable dwell times.

- c. Any number of “screen control objects” from any screen and link them directly to any other screen. Screen control objects may be defined as the following types:
- 1) Frame – a 3D-style animated button.
  - 2) Rectangle – a 2D or 3D-style rectangle with, or without border.
  - 3) Rectangle – a 2D or 3D-style rectangle with filleted corners and with, or without border.
  - 4) Ellipse – a 2D or 3D-style ellipse or circle with, or without border.
  - 5) Triangle – a 2D or 3D-style 3-sided object with, or without border.
  - 6) Diamond – a 2D or 3D-style 4-sided, diamond-shaped object with, or without border.
  - 7) Pentagon – a 2D or 3D-style 5-sided object with, or without border.
  - 8) Hexagon – a 2D or 3D-style 6-sided object with, or without border.
  - 9) Octagon – a 2D or 3D-style 8-sided object with, or without border.
  - 10) Arrow – a 2D or 3D-style, arrow-shaped object with, or without border.
  - 11) 4-pointed Star – a 2D or 3D-style, 4-pointed star-shaped object with, or without border.
  - 12) 5-pointed Star – a 2D or 3D-style, 5-pointed star-shaped object with, or without border.
  - 13) Cube – a 2D or 3D-style, isometric cube-shaped object with, or without border.
  - 14) Cylinder – a 2D or 3D-style, isometric cylinder-shaped object with, or without border.
  - 15) Circle-Slash - a 2D or 3D-style, circle-with-slash (international “No” symbol)-shaped object with, or without border.
  - 16) Polygon/Polyline – a 2D or 3D-style, multipoint vector object with an irregular shape.
- d. Images and Screen Objects: Any standard image to be used in a user interface screen, either as a background image or as the foreground image for a screen control object. Any number of “actions or macros” steps, of any series of control selections, may be assigned to each screen control object. Each screen object shall be capable of being assigned up to 255 states. A screen control object’s state shall be determined by the state of one or more evaluation criteria objects. Evaluation criteria objects describe the real-time status of I/O points, Doors, Call Stations, Alarm Zones, Current Computers, Current Logged-on User(s), Current Security Access Level, Current Screen, or database field(s). Each state shall be capable of being assigned up to 255 commands sequences for each instance of:
- 1) Mouse-Down - When the left mouse button (or touch screen touch ) occurs within the active area of the screen object.
  - 2) Mouse-Up - When the left mouse button (or touch screen touch) is released while within the active area of the screen object.

- 3) On-Active - When a display control (based upon evaluation criteria) is in its active state – causing the screen object to switch to that state. The Active state of any screen object may be determined by the active condition of any number of separate, evaluation criteria objects.
- 4) It shall be possible to associate the evaluation criteria objects via Boolean relationships, i.e.: AND, OR, XOR, etcetera.
- 5) It shall be possible to qualify evaluation criteria objects as inverted (NOT), acknowledged (ACK), or shunted (SHUNT).
- e. All graphical screen control objects shall be completely configurable with regard to visual effects. Visual effects may be programmer-selectable as follows:
  - 1) Borders:
    - a) Inside, middle and outside with and raised (3D) effects.
    - b) Border colors – selectable from complete 32-bit color pallet.
    - c) Highlight and shadow effects.
  - 2) Interior:
    - a) Hatch styles selectable from 45 different patterns and color-selectable from complete, 32-bit color pallet.
    - b) Solid color fill – selectable from complete 32-bit color pallet.
    - c) Gradient color fill – selectable from 9 different gradient patterns and 2-color selectable from complete, 32-bit color pallet.
    - d) Texture fill – selectable from any number of bit-mapped textures. Textures will automatically “tile” to fit the object fill.
- f. Invisible – screen control objects may be rendered invisible on a state-by-state basis.
- g. Font – Any Windows-compatible font style and script style with full range of standard font effects, i.e., bold, italic, strikeout and underline, with color selectable from a 16-color high-contrast color pallet.
2. Rules and Logic Capabilities: The ACS shall support a robust and complete rules and logic engine with the following minimum capabilities:
  - a. Up to 65,535 “automation” objects that will enable the user to define and execute complex Boolean operations related to any series of control selections or I/O activity.
  - b. Up to 65,535 “control counter” objects that will allow the user to execute threshold increment and/or decrement operations related to any series of control selections or I/O activity. It shall be possible for the user may to define control counter values as executable “set-points” within the range of a control counter object.
  - c. Up to 65,535 “timer” objects that shall allow the user to execute flexible timer operations related to any series of control selections or I/O activity.
  - d. Any number of “database-link” objects that shall allow the user to view and manipulate database table fields while in run mode from the GUI.

- e. Any number of “access control tracking” objects that will allow the user to track access control activity, including photos and cardholder data-fields, for any selected access control reader object.
- f. Any number of “shared-screen” objects that will allow the user to define screen object functionality in a single, centralized User Interface (UI). The shared screen objects shall be capable of being assigned to any number of different screens.
- g. Any number of “door construct” objects that will allow the user to define all door-related activities from a single UI. The door construct object will contain all of the programming with regard to standard and exceptional door activities, including:
  - 1) Entry and exit events and I/O point assignments (authorized entry/exit)
  - 2) Timer properties for:
    - a) Door Lock time (strike time)
    - b) Door Re-Lock delay time
    - c) Door Open Too Long (DOTL)
    - d) Door Unlock Too Long (DUTL)
  - 3) Alarm properties for:
    - a) Door Forced
    - b) Door Open Too Long (DOTL)
    - c) Door Unlock Too Long (DUTL)
  - 4) Integration of ancillary Door-Related Devices to include:
    - a) Entry and Exit Intercom stations
    - b) Entry and Exit CCTV Cameras
    - c) Entry and Exit Auxiliary Alarm devices
  - 5) User-configurable door action properties for:
    - a) Door Unlock
    - b) Door Open
    - c) Communication Failure
    - d) General Camera Call-up
    - e) Camera Call-up on Entry
    - f) Camera Call-up on Exit
  - 6) User-configurable, Entry-or-Exit specific door action properties for:
    - a) Authorized Entry
    - b) Authorized Exit
    - c) Denied Entry for:
      - (1) Undefined Card
      - (2) Invalid Card

- (3) Invalid Reader
- (4) Invalid Time
- (5) Escort Required
- (6) Passback violation
- d) Denied Exit for:
  - (7) Undefined Card
  - (8) Invalid Card
  - (9) Invalid Reader
  - (10) Invalid Time
  - (11) Escort Required
  - (12) Passback violation
- h. Any number of “global anti-pass-back zone” objects that will allow the user to define multiple, nested anti-pass-back security zones under host control. The global anti-passback violations shall include:
  - 1) Exempt – card holder is exempt from anti-passback rules.
  - 2) Soft – a violation is recorded but passage is granted.
  - 3) Hard – a violation is recorded and passage is denied.
  - 4) Forgive – the operator may forgive individual passback violations.
  - 5) Escalation – a violation count is assigned to cardholders by card group and the violation penalty is escalated when this set-point is reached by an individual cardholder:
    - a) Soft-to-hard – soft violations are escalated to hard.
    - b) Revoke – violations are escalated to card-revoked.
- i. Any number of “musterling” objects that will allow the user to define and maintain musterling points that can provide a real-time list of “mustered” personnel in the event of an evacuation emergency. The musterling event shall be capable of being user-configured such that an emergency will automatically forgive all passback violations.
- j. Any number of “interlock” groups that will allow the user to define and maintain interlocking door relationships from a single UI. Interlock objects shall allow any number of doors to be interlocked together through PLC or SPLC Ladder programming. Host dependent or physical relay / door position switch interlocking shall not be permitted. Interlock objects must support interlock override and violation – exception – handling as standard functions, requiring no additional programming.
- k. Any number of “call station” objects that will allow the user to define all call station-related activities from a single UI. The call station object will contain all of the programming with regard to standard and exceptional call station activities, including:
  - 1) Call In Input

- 2) Call In Output
  - 3) Secondary Call In Output
  - 4) Active Call Input
  - 5) Disabled Point
  - 6) Auto-Re-enable Counter
  - 7) Selected Counter Value
  - 8) Tamper Point List
  - 9) Acknowledge Timeout, Timeout Override Counter, and Timeout Output
  - 10) Process Timeout, Timeout Override Counter, and Timeout Output
  - 11) Ability for the Acknowledge and Process Timeouts to be in seconds or minutes.
  - 12) Automated actions for the following event types:
    - a) Call In
    - b) Call In Acknowledgement
    - c) Call In Acknowledge Timeout
    - d) Disabled
    - e) Enabled
    - f) Selected
    - g) Deselected
    - h) Processed
    - i) Process Timeout
    - j) Tamper
    - k) Tamper Restore
1. Any number of “alarm zone” objects that will allow the user to define all alarm zone-related activities from a single UI. The alarm zone object will contain all of the programming with regard to standard and exceptional alarm zone activities, including:
- 1) Optional Alarm Expressions to determine alarms
  - 2) Sensor List for determine alarms, each sensor having optional points for:
    - a) Latching
    - b) Failure
    - c) Disable
    - d) Control Output
    - e) Alarm Output
    - f) Access/Mask Input
    - g) Auto-secure Timeout

- h) Auto-secure Timeout counter override
  - i) Selected Counter Value
  - j) Tamper Point List
  - k) Acknowledge Timeout, Timeout Override Counter, and Timeout Output
  - l) Process Timeout, Timeout Override Counter, and Timeout Output
- 3) Ability for the Acknowledge and Process Timeouts to be in seconds or minutes.
  - 4) Auto-Acknowledge and Auto-Process Inputs
  - 5) Multiple Sensor Alarms for determining alarm state based on multiple sensor in the same or multiple zones in a given time period.
  - 6) Automatic camera switching on alarm
  - 7) Tamper List
  - 8) Failure List
  - 9) Disabling an alarm zone when in failure
  - 10) Automated actions for the following event types:
    - a) Selected
    - b) Deselected
    - c) Alarm
    - d) Multiple Alarm
    - e) Acknowledged
    - f) Processed
    - g) Tamper
    - h) Failure
    - i) Access/Mask
    - j) Secure
  - 11) Automated actions for the following event types on a per sensor basis:
    - a) Alarm
    - b) Failure
    - c) Disable
  - 12) Any number of “Guard tour” objects that will allow the user to set up and maintain sequenced and random guard tours utilizing any number of check-in points defined in the system.
  - 13) “Dead-man mode” operation that will allow the user to set up and maintain watch intervals that will provide a special alarm event to occur when no keyboard or workstation activity is logged at any given workstation for a user-defined span of time (indicating an unattended workstation).

- 14) Full administrative control of alarm and event routing, and display masking, based on workstation, user, or a combination of workstation and user.
  - 15) Full administrative control of alarm and event queue displays such that it is possible to define any number of queues, assign subsets of event activities based on hardware type, area, or any other logical grouping of like functionality. The number of simultaneously displayed queues shall be limited only by the availability of viewable screen area. It shall be possible to “pop-up” queues as they are populated by active events and “pop-off” queues automatically once all events are cleared. It shall be possible to manually “pop-up” and “pop-off” queues by user selection.
  - 16) The ability to program control and routing parameters such that it is possible to assign, wrest or release control of alarm and events from any workstation in real time and on demand.
  - 17) Any number of Custom Script objects that allow the programmer to define multi-step “macro” functionality. The scripts shall be portable for import and export.
  - 18) Any number of Conditional Operations for rules evaluation, including IF-THEN-ENDIF programming structures.
  - 19) Any number of formatted Event outputs that allow the programmer to define external event formats to be automatically written to disk.
3. System Configuration Capabilities: System configuration (project file development) shall have the following, minimum, capabilities:
- a. A graphic drawing system that is screen object orientated which allows the user the capability to arrange and modify objects. (I.e. Align Top, Align Bottom, Align Left, Align Center Points, Space vertical, Send to Front, Send to Back, Space Horizontal, Rotate, label, Make Same Size, Paint Fonts, Paint Colors and Effects, etc.)
  - b. System Configuration shall be accomplished with drag and drop point references from a tree structure file system display. No script language shall be necessary to accomplish operational and functional requirements specified. Tree elements shall be capable of drag and drop duplication and movement within the tree display. It shall be possible to “localize” the tree display in order to provide an abbreviated view of any element of the tree for ease of programming. Graphical image and sound directory objects and their children shall be capable of drag and drop directly from the tree to the screen map objects. User defined text descriptors for tree parent and children objects shall be supported with file names of up to 255 characters in length. Duplicate file names shall be supported.
  - c. System programming wizards shall allow the user to reprogram system elements from the parent node in the tree structure. The reprogramming wizard shall allow the user to reprogram the parent node only or all children of the parent node as well. The reprogramming wizard shall allow for text changes and re-assignment of I/O points to any object or objects within a parent-child structure.
  - d. Object copy wizards shall allow a copy of an object to be reprogrammed - I/O point assignments, text changes, and object associations – automatically upon copy.
  - e. Object creation wizards shall automatically create “smart” objects when dragged-and-dropped from the tree onto a screen.

- f. Object replication shall allow for automatic creation of multiple “smart” objects that derive their point references from the tree without the necessity for programming each element individually.
- g. An unlimited number of user defined site maps as the user interface and control screen. The ACS shall allow the site maps to be generated offline and imported into the system. The ACS shall allow the system administrator to place Icons representing each integrated device function on any map screen. The ACS shall allow the system administrator to define site maps, icons, and icon definitions in real time, to ensure that normal system operations are not disrupted.
- h. System functions assignable to any screen shall include 1) command sets to be automatically executed by the system upon an operator request or any combination of requests, and 2) command sets to be automatically executed by the system upon the occurrence of a pre-selected system alarm or event or any combination of alarms or events. Command sets shall be a collection of system commands as selected by the system administrator. Commands available for selection by the system administrator to create a command set shall include all commands supported by the integrated device or subsystems. Command set shall be categorized by like function and shall include:
  - 1) I/O Control
    - a) SetOn - Sets and I/O point to its ON state
    - b) SetOff - Sets and I/O point to its OFF state
    - c) Pulse - Temporarily sets and I/O point ON then OFF
    - d) TempPulse – Sets an I/O point to its ON state for a user-entered number of minutes (0-999).
    - e) Toggle -Toggles an I/O point
    - f) SetOnPush - Sets an I/O point to its ON state, and then sets it OFF when the screen is exited.
    - g) ForceOn – Forces an I/O point to remain in an ON condition. All other commands for this point will be ignored except ForceOff and ForceNormal.
    - h) ForceOff - Forces an I/O point to remain in an OFF condition. All other commands for this point will be ignored except ForceOn and ForceNormal.
    - i) ForceNormal - Returns an I/O Point to its normal operating condition without changing the state of the point.
    - j) IncrementCounter – Increments a Counter I/O point by the user-programmed interval.
    - k) DecrementCounter – Decrements a Counter I/O point by the user-programmed interval.
    - l) ResetCounter – Resets the Counter I/O point to its user-programmed “start” state.
    - m) StartTimer – Starts a user-defined Timer I/O point.

- n) KillTimer – Stops the user-defined Timer I/O point and prevents the execution of any actions assigned to the Timer.
  - o) ForceTimer – Forces a Timer I/O point to complete its cycle and execute any actions assigned to it.
- 2) Door Control
- a) LockDoor – Sets the door lock point on a Door Construct to its locked state.
  - b) UnLockDoor – Sets the door lock point on a Door Construct to its unlocked state.
  - c) TempUnLockDoor - Sets the door lock point on a Door Construct to its unlocked state for a user-entered number of minutes (0-999).
  - d) PulseDoor - Causes the door lock point on a Door Construct to cycle through its unlock-lock cycle (unlocks for the programmed strike time).
  - e) SwitchEntryCamera – Switches the camera view for the entry side of the door construct.
  - f) SwitchExitCamera – Switches the camera view for the exit side of the door construct.
  - g) ConnEntryIntercom – Connects to the entry-side intercom station.
  - h) DiscEntryIntercom – Disconnects the entry-side intercom station.
  - i) ConnExitIntercom - Connects to the exit-side intercom station.
  - j) DiscExitIntercom - Disconnects the exit-side intercom station.
  - k) StartEntryAlarm – Sets the entry-side auxiliary alarm point to its ON state.
  - l) StopEntryAlarm - Sets the entry-side auxiliary alarm point to its OFF state.
  - m) StartExitAlarm - Sets the exit-side auxiliary alarm point to its ON state.
  - n) StopExitAlarm - Sets the exit-side auxiliary alarm point to its OFF state.
  - o) ShuntDoorForced – Shunts the door construct’s Door Forced Open alarm.
  - p) UnShuntDoorForced – Removes any shunts on the door construct’s Door Forced Open Alarm.
  - q) ShuntDOTL - Shunts the door construct’s Door Held Open Too Long alarm.
  - r) UnShuntDOTL - Removes any shunts on the door construct’s Door Held Open Too Long Alarm.
  - s) ShuntDUTL – Shunts the door construct’s Door Unlocked Too Long alarm.

- t) UnShuntDUTL - Removes any shunts on the door construct's Door Unlocked Too Long Alarm.
- 3) Screen Control
- a) PopUp – Causes a Screen to “pop up” at a user-defined XY coordinate and overlay the current screen.
  - b) PopOff – Causes a “pop up” screen to be dismissed from view.
  - c) PushScreen – Causes a new screen to display and “push” the current screen off.
  - d) PopScreen – Causes the previously pushed screen to display in place of the current screen (back screen).
  - e) PopUpQueue - Causes a user-defined queue to be displayed at user-defined XY coordinates on the screen.
  - f) PopOffQueue – Causes a user-defined, popped-up queue to pop off.
  - g) Display – Causes a new screen to be displayed and sets it as the primary screen.
  - h) CleanScreen – “Locks” the touch screen for cleaning.
- 4) Point Control
- a) ShuntAlarm – used to shunt (bypass) an alarm so its state is not viewed.
  - b) UnShuntAlarm – returns an alarm that has been shunted so its state can be viewed again.
- 5) Video
- a) PopUpVideo – used to display a live video image from a designated camera.
  - b) PopOffVideo – used to close a live PopUpVideo display.
  - c) LiveCompare – used to display a split screen allowing an archive video image to be compared with a live video image. To evoke this action drop a camera point into the camera control drop field of a door within an access control panel, upon a card read the “Live Compare” window will display. In settings of a computer, a user can evoke this action by checking the “Invalid Read” or “Valid Read” in the Live Compare section of the computer's properties.
  - d) LiveVideo – directs a live video feed to the screen. This action requires a LiveVideo object that is to be started. This action must be followed a PlayVideo action.
  - e) PlayVideo – action will start the video in the video object. The target of this action must be the LiveVideo object that is to be played. This action must follow a LiveVideo action.
  - f) PauseVideo – will pause the video play. The target of this action must be a LiveVideo object.
  - g) StopVideo – will stop the video play. The target of this action must be a LiveVideo object.

- h) StartRecording – will begin recording. The target of this action must be a LiveVideo object.
- i) Stop Recording – will stop recording. The target of this action must be a LiveVideo object.
- 6) Macro
  - a) Macro – marks the beginning of a macro. Every Macro created must begin with this action first. A target is not applicable to this action.
  - b) RunMacroN – (Where N is the number of the Macro.) Runs the Macro (up to eight for each screen object) on a given screen object. A target is not applicable to this action.
- 7) Group Control
  - a) GroupSetOn – sets selected objects to ON as part of a group action.
  - b) GroupSetOff – sets selected objects to OFF as part of a group action.
  - c) GroupSet – defines a group of objects to perform an action. When used, this action allows objects to be individually selected and deselected.
  - d) GroupSetAll – selects all items to perform an action.
  - e) GroupClearAll – clears any selected items previously selected to perform a group action.
- 8) Database
  - a) MoveFirst – move focus to the first record in the selected record set.
  - b) MovePrevious – move to the previous record in the selected record set.
  - c) MoveNext - move to the next record in the selected record set.
  - d) MoveLast - move to the last record in the selected record set.
  - e) RecordAdd – add a record to the selected table.
  - f) RecordChange – edit a record in the selected table.
  - g) RecordDelete – delete a record from the selected table.
  - h) RecordCancel – cancel add/edits/deletes.
  - i) RecordSave – save the record in the selected table.
  - j) FilterNew – build a new query filter.
  - k) FilterBy – set filter query specifics.
  - l) MatchExact – match query to exact specifics.
  - m) MatchPartial – match query to partial specifics.
  - n) MatchPartialStart – match query to partial specifics “starts with – “wildcards.
  - o) MatchPartialEnd – match query to partial specifics “ends with – “wildcards.
  - p) MatchNotEqual – match query to not-equal value.

- q) MatchLessThan – match query to less than value.
  - r) MatchGreaterThan – match query to greater than value.
  - s) MatchLessOrEqual – match query to less-than-or-equal value.
  - t) MatchGreaterOrEqual - match query to greater-than-or-equal value.
  - u) SortBy – sort query results by field name.
  - v) FilterSet – executes a filter command sequence.
- 9) General
- a) Play – used to play a sound wave file. The target for this action must be a sound or TTS message.
  - b) LoadProgram – starts another application’s executable file. The target of this action is a User Program.
  - c) MaskComputer – selects a target computer for the actions ForceMask and ForceRoutingMask. The target for this action must be a computer node.
  - d) ForceMask – forces a System Mask to the computer set with the MaskComputer action. The MaskComputer action must proceed this action. The target for this action must be a System Mask.
  - e) IntercomCall – initiates the Call a Station command, which makes the final connection to the receiving intercom station.
  - f) IntercomSet – used to set the transmitting intercom station.
  - g) SendCommand – builds a command and sends it to the driver.
  - h) VirtualizeRTU – sets a RTU from a live state to a virtual state. The target for this action must be a RTU.
  - i) UnVirtualizeRTU – sets a RTU from a virtual state to a live state. The target for this action must be a RTU.
  - j) OnlineDriver – brings the targeted RTU’s driver online. The target for this action must be an RTU.
  - k) OfflineDriver – brings the targeted RTU’s driver offline. The target for this action must be an RTU.
  - l) ForceRoutingMask – forces a Routing Mask to the computer set with the MaskComputer action. The MaskComputer action must precede this action. The target for this action must be a Routing Mask
  - m) LockWorkstation – locks the target computer out from managing/operating the Intelli-Site Project. The target for this action must be a computer node.
  - n) UnlockWorkstation – unlocks a currently locked out target computer, re-establishing managing/operating functionality to the target computer. The target for this action must be a computer node.
  - o) ZoneReport – shows all cardholders whose presence is within the target zone. The target for this action is an APB Zone.

- p) MusterReport – shows all cardholders whose presence is not within a Mustering Zone or Outside. There is no target for this action.
  - q) StartMustering – begins a Mustering Event.
  - r) StopMustering – ends a Mustering Event.
  - s) Page - Send a TTS Page to a Workstation
  - t) DownloadSettings – forces a download of settings (parameters) to an Access Control device.
  - u) DownloadCards - forces a download of card data to an Access Control device.
  - v) RunReport – causes a pre-defined report to run.
  - w) PrintReport – sends a pre-defined report to the printer.
  - x) Authenticate – requires supervisory concurrence prior to execution of the next command.
  - y) Validate – similar to Authenticate. If the target computer, user or System Mask does not match the current, the remaining actions in the action grid are not executed. Does not require specific user interaction.
- 10) Event - Information Manager (IM) Actions
- a) SelectEvent – used to open an event from the Queue Control tab within the IM. It functions the same as right-clicking the mouse to open the Alarm Acknowledge/Clear Dialog.
  - b) AckEvent – used to acknowledge the selected alarm in the Queue Control of the IM.
  - c) ClearEvent – used to clear the selected alarm from the Queue Control of the IM.
  - d) CurrentEvent – highlights and selects an event (if none is highlighted) in the Queue Control of the IM. It functions the same as a single left mouse click on a highlight alarm event.
  - e) UpEvent – used to move up one event on the Queue Control of the IM.
  - f) DownEvent – used to move down one event on the Queue Control of the IM.
  - g) AckAllEvent – used to acknowledge all listed events on the Queue Control of the IM.
  - h) ClrAllEvent – used to clear all listed events on the Queue Control of the IM.
- 11) Conditionals – If-Then-Else conditional actions
- 12) All icon command sets must be defined by the system administrator in real time and become active immediately upon definition. All definitions must be able to be changed while the system is on-line and operational.
- 13) All system functions shall be implemented by command set definitions. The functions to be performed automatically by command sets and shall be limited only by the type of devices and subsystems that have been integrated and the

capabilities of those devices. No limit shall be set on the number of commands that may be included in a command set, the number of command sets and the number of icons to which the command sets can be assigned.

- 14) Command sets shall be capable of being modified by the system administrator at any time without interruption of the system's normal operation. Command set modifications made in real time shall provide the system with the ability to have its functionality redefined, upon demand, in response to different managerial, operational, or security concerns, as they may occur.
- 15) Integrated video badge generation capability that will allow the user to graphically define any number of badge layouts, capture portrait images, and service badge printing to any printer listed as compatible within the applicable Windows hardware compatibility list.
- 16) System Administration: The ACS shall support the following, minimum, System Administration capabilities:
  - a) Operator access to the system to be defined by the system administrator. Each authorized operator shall have a log on name and password as well as a predefined authorization to access and/or perform certain system functions. Authorized user accounts may, upon system administrator selection, be derived from Windows User accounts or Windows User Group accounts. Windows strong authentication is used for user accounts. The ACS shall remain active, processing all information and shall not allow the last operator to log off the system without a pop-up warning. When no user is logged on to the system, system alarms and prompts are accumulated by the system until an operator logs on and takes the necessary actions to clear the alarms and prompts. If no operator is logged on, the ACS shall display the log-on prompt within a welcome screen to be defined by the owner. The log-on prompt contains operator fields for users to enter their log-on name and password. If an operator enters their log-on name and password sequences, and if the system verifies them as being valid, then the ACS shall display the user's pre-defined home screen. The ACS shall allow an operator to select a Log Off button from the command bar and return to the Log-on window. The ACS shall also be capable of preventing administrator-defined operators from logging off the system. Logon shall be accomplished via keyboard input, card read input, or on-screen keyboard/randomized hex keypad (on the touch screen console). Logon may also be granted variously based upon user and workstation combinations.
  - b) The ACS shall be capable of being operated from a remote location utilizing dial-up or LAN/WAN TCPIP communications by a technical support specialist. The remote capabilities shall support diagnostic and help-desk operations and include the ability to upgrade software.
  - c) The ACS shall be capable of providing server redundancy. In the event of a primary server failure, the backup server will assume operation of the system automatically with no loss of data or interruption of I/O activity. Redundancy implementation shall not include the use of third-party software or hardware and shall not involve the use of a manual or automatic hardware "fail-over controller." Redundancy must be

able to optionally support dual redundant Ethernet communications paths via multiple NICs.

- d) The ACS shall be capable of providing multiple-server, enterprise-level functionality. Any number of servers or redundant server pairs may be linked so that operational and database information can be shared throughout the enterprise. Drivers shall be capable of failing to the nearest server with an enterprise link when a server becomes unavailable due to a hardware failure. The facility connected to the failed hardware shall continue to function under the same conditions as it did while the facility server was in place.

17) ACS Reports

- a) The system shall be capable of producing the following reports, based on logged historical events over a specified date and time period, both individually and in any combination. The user shall be able to display report data on screen as well as print a hard copy to any ACS printer:
  - (13) Report of ACS alarm transaction events for a selected alarm or group of alarms.
  - (14) Report of ACS operator acknowledgments for a selected alarm or group of alarms.
  - (15) Report of ACS operator entered comments in conjunction with alarm acknowledgments.
  - (16) Report of ACS manual operator system commands such as camera call-ups, input point activation/deactivation, door locking and unlocking, interlock override, Intercom calls, emergency release functions, and auxiliary relay activation/deactivation.
  - (17) Report of ACS automatic time controlled system commands such as automatic input point activation/deactivation, and automatic auxiliary relay activation/deactivation.
  - (18) Report of ACS activity such as port traffic, system start up and shutdowns, and system failures.
- b) All reports shall be selectable by time and date range as selected by user.
- c) All reports shall be capable of running automatically, based upon a user-defined time schedule.
- d) Report generation software shall be provided to develop generic and advanced reports in industry standard RPT report format files. Modification of reports and data shall be user definable and be relational to active database information. Report management software shall not require system to be idle for query and report generation.

18) System Operation Requirements:

- a) Alarm Processing.

- (19) The operator shall be able to select the alarms or events displayed in the event queue(s) by priority. Up to 255 priority levels shall be supported.
- (20) The operator shall be able to view and acknowledge alarms and events from any mode of operation.
- (21) It shall be possible to inform the operator of an alarm condition via an audible tone, a pop-up display, or any combination of animation types on the screen. Alarm acknowledgment may be performed on all alarms, alarms in a single group, alarms in a collection of groups defined in an alarm group hierarchy, or on a point-by-point basis.
- (22) Pre-recorded audio messages shall be linked to alarms based on user selection.
- (23) Text-to-Speech audio messages shall be provided with linkage capability to any system event or alarm.
- (24) An ALARM QUEUE, or multiple, user-defined ALARM QUEUES, window(s) shall be provided that will display all alarms, subject to window size. Information to be displayed includes the priority of the alarm, the time alarm occurred, the alarm description text, and the status of the monitored point. This window shall be separated into three partitions, one for active events and alarms, one for all events, transactions, and alarms displayed in a log file, and one for all system points that have been overridden or shunted. Events listed in the active alarm queue shall be sorted by priority (highest priority at the top of the list) and by time of occurrence. Scroll bars adjacent to each partition shall permit the operator to view all alarms and events in each partition separately.
- (25) An ALARM PROCESSING window shall be provided that will display descriptions and instruction text for the alarm presently being processed, and provide for entry of operator comments. This pop-up window shall open when the operator selects an alarm for processing from the ALARM QUEUE window(s).
- (26) Any alarm point that has a digital video channel recording parameter (pre-and-post alarm) shall be displayed with a distinctive alarm symbol indicating to the operator that there is recorded video associated with the alarm. The operator shall be able to select the special icon and immediately recall the recorded alarm event as recorded video-on-demand. In addition, the user shall be able to search previous alarm events for associated video and retrieve the event-recorded video on demand.
- (27) Selection of any alarm, in either partition, shall automatically bring the ALARM PROCESSING window to the foreground, displaying the associated information in the ALARM PROCESSING window, display the alarm's associated map (if so defined), and cause the alarm selected for processing to be highlighted in the ALARM QUEUE window.

- (28) It shall be possible for the system administrator to pre-define alarm acknowledgement comments for alarm events. The operator may then select a pre-defined comment for inclusion in the event log by selecting the pre-defined comment. It shall also be possible for the operator to edit and/or append custom comments to the pre-defined acknowledgement comments.
- (29) Any I/O point shall be capable of submitting alarm event data to an MS-Outlook express email client upon activation. It shall be possible for the user to define email alarms on a point-by-point basis, and, at minimum, to identify the recipient or multiple recipients (up to 255 accounts). Email notifications shall be selectable based upon activation (hi), clear (low), or upon any state change (hi or low transition) of any I/O point.
  - (i) Integrated video event capture capability that will allow the user to capture and store video still and clip events related to any series of control selections or I/O activity.
  - (ii) The interaction time between system input at the touch screen and the activation of a field device shall not exceed one quarter (0.25) second. The interaction time between field input device and display on the operator screen shall not exceed one quarter (0.25) second. The interaction time to recall a complete graphic screen shall not exceed one half (0.5) second under normal operation and one (1.0) second under single station control of entire facility.

#### H. ACS Database

1. The ACS shall utilize an industry standard Object Database Manager System (ODBMS), MS SQL, or PostgreSQL to support all system functions. The ODBMS shall be capable of supporting full SQL functions as well as data import/export operations utilizing a LAN/WAN or dial-up communications. Systems that do not support SQL functions are not acceptable. Systems that utilize a unique proprietary database are not acceptable.
2. The ACS shall utilize a system database that contains system information, which defines the ACS, devices installed, and their configuration. Administrative and other internal files, such as authorized user access, system status and operator logs, shall also be maintained in the system database.
3. The ACS shall also utilize an application database that contains database information for all subsystems, such as access, alarm monitoring, intercom, VSS, and door control. The ACS shall consolidate all application databases as required to support a single point of administration, data entry and reporting.
4. The ACS shall also utilize a history database that contains system transaction event records for all transactions that occur within the ACS. The history database shall store the most recent 500,000 transaction events on the internal hard disk.
5. The ACS shall provide a built-in archiving and automated backup facility that can be set to automatically back up all operational data to any local or network-accessible mass storage media at a user-defined interval, or upon user demand. The archiving and

automated backup facility shall be fully integrated into the ACS and shall not require 3rd-party support software.

6. Database provided shall be a proven, mature, off-the-shelf, multi-user, relational database program and generate all required data structures and linkage between related databases. Either a LAN version or a host version is acceptable.
7. The ACS application shall support PostgreSQL or MS SQL Server.
8. The database program furnished as part of this work shall provide for the complete management of distributed relational databases and shall be furnished with programming and query capabilities that use ANSI Standard Structured Query Language (SQL).
9. The database program shall generate, store, and mirror on each file/print server identical copies of all databases that are required for critical and essential functions. Data records and files generated by other ACS application programs shall be stored on the file server(s) in a format, which is compatible with, and directly accessible by, the database program.
10. It shall be possible to display, and to print each database record in separate, Owner-forgettable configurations.

### 2.3 FIELD PANEL HARDWARE

- A. Control Panel Capacities: each Access Control Panel, (Panel) shall support distributed intelligence. Field Panel Hardware may contain the following:
  1. Intelligent Reader Module
  2. Intelligent Input Module
  3. Intelligent Output Module
- B. Each Panel shall contain its own:
  1. Processor and memory
  2. Shall be capable of supporting:
    - a. Up to 4 access control keypads or card readers
    - b. Up to 8 supervised monitored alarm points
    - c. Up to 4 output relays. Relays shall be rated at 250V and 8 A with 5 amp individual fusing
    - d. Up to 10,000 card holders.
    - e. Facility Code(s) 4 Global or unlimited when entered per card.
    - f. 64 timezones each having four intervals of time
    - g. Two levels of fail-safe
    - h. Event buffer, 4,000 transactions stored in a First In First Out (FIFO) basis
    - i. Real Time Clock supporting Leap Year
- C. Interface with various manufactures of card reader, keypad technologies
  1. Technologies include: proximity, insertion and swipe readers and be compatible with the standard Wiegand 26, 32, 35, 37, 40, 48, and 75 bit protocols.

2. Reader Types Supported: The system shall support the following card reader technologies:
  - a. Wiegand
  - b. Magstripe
  - c. Proximity
  - d. 8-bit Pin Keypad Support
- D. Field panel enclosures shall be key locked and keyed alike with all other key locked enclosures for ACS equipment.
- E. Tamper switches shall be provided and installed on the field panel enclosures and wired to the inputs of the ACS input modules dedicated as tamper monitoring at each Access Control System enclosure.

#### 2.4 CARD READER

- A. Provide for all staff doors as outlined on the Contract Drawings, high-security vandal-proof proximity card readers. It shall meet the following requirements:
  1. It shall be vandal-resistant.
  2. It shall be compatible with "HID" proximity card technology.
  3. It shall support 8 or 26-bit Wiegand keypad output or 8-bit smart output.
  4. It shall feature indelible graphics and labeling.
  5. It shall mount to standard electrical back-boxes (single gang).
  6. All mounting hardware shall be tamperproof, center-pin torx head hardware (six-lobe).
  7. A Lifetime warranty shall be provided.
- B. Provide proximity card readers shall comply with UL-294 standards.
- C. The reader shall work with passive proximity cards. A red LED shall indicate power to the reader. When a proximity card is presented to the reader, the red LED shall flash green and the beeper shall sound briefly indicating to the cardholder that the card was read. A longer duration flash and beep shall follow for an authorized card. On reader power-up, an internal self-test routine shall check and verify the setup configuration, determine the internal or external control of the LED and beeper and initialize the reader operation.

#### 2.5 ACCESS CARD REQUIREMENTS

- A. Coordinate with the Owner to integrate with the Owner's existing ACS and use of existing access cards.

#### 2.6 ACCESS CONTROL SYSTEM CABLING AND INFRASTRUCTURE

- A. Contractor shall follow all manufacturer and specified requirements for the Access Control System cabling and infrastructure. Refer to drawing T-001 for required cabling types per each ACS and Door Hardware device.

2.7 DOOR POSITION SWITCHES

- A. Refer to the Division 08 Specifications and the Architect's door hardware Schedule and coordinate with the door hardware supplier for door position switches. Provide wiring and integration with the Access Control System.

2.8 REQUEST-TO-EXIT (REX)

- A. Refer to the Division 08 Specifications and the Architect's door hardware Schedule and coordinate with the door hardware supplier for request-to-exit devices. Provide wiring and integration with the Access Control System.

2.9 DOOR RELEASE PUSHBUTTONS

- A. Refer to Specifications Section 281523 and provide integration with the Security Intercom System for remote release of doors associated with intercom substations. Pressing the door release button on the associated master intercom station shall trigger the Access Control System to unlock the associated door.

2.10 MAGNETIC DOOR HOLD-OPENS

- A. Refer to the Division 08 Specifications and the Architect's door hardware Schedule and coordinate with the door hardware supplier for magnetic door hold-opens. Provide wiring and integration with the Access Control System where required.

2.11 ELECTRIFIED LOCKSETS

- A. Refer to the Division 08 Specifications and the Architect's door hardware Schedule and coordinate with the door hardware supplier for electrified locksets. Provide wiring and integration with the Access Control System.

2.12 ELECTROMAGNETIC DOOR LOCKS

- A. Refer to the Division 08 Specifications and the Architect's door hardware Schedule and coordinate with the door hardware supplier for electromagnetic door locks. Provide wiring and integration with the Access Control System.

2.13 LOCK POWER SUPPLIES

- A. Provide 24VDC and/or 12VDC Power Supplies as required to provide power to the electrified locksets and ACS equipment at each location as indicated on the Contract Drawings. Provide infrastructure and installations as required to power and control the electrified locksets.
- B. Coordinate with the existing door hardware to ensure compatibility between the electric strikes to be provided and the power supplies and access power controllers.
- C. Access power controllers shall be used to power and control the electric strikes and shall meet or exceed the following requirements or as required to be compatible with the electric strikes:
  - 1. Eight (8) relay inputs for control from the ACS control boards.
  - 2. Eight (8) independently controlled outputs at 12VDC.

3. Minimum 600mA @ 12VDC output for each output simultaneously.
  4. 10A main fuse.
  5. 12VDC power input to be compatible with the access power controller power supply.
  6. Overall dimensions and mounting points compatible with the associated enclosure.
- D. Access power controller power supplies shall be fully compatible with the access power controllers and shall meet or exceed the following requirements:
1. Compatible with the 120VAC input provided by the EC.
  2. Single 12VDC output with 10A continuous.
  3. Short circuit and thermal overload protection.
  4. Overall dimensions and mounting points compatible with the associated enclosure.
- E. Provide battery backed emergency power for sixty (60) minutes battery runtime for each location.
- F. Power supply power fault shall be wired to the input points of the ACS input modules dedicated for this purpose.
- G. Access power controllers shall be as manufactured by Altronix ACM8CB, OSSI, or approved equal.
- H. Access power controller power supplies shall be as manufactured by Altronix OLS200, OSSI, or approved equal.
- 2.14 INTRUSION MOTION SENSORS – CEILING MOUNTED
- A. Provide dual technology motion detectors as shown on the Contract Drawings.
- B. Motion sensors shall meet all of the following requirements at a minimum:
1. Dual technology passive infrared and microwave to minimize false alarms.
  2. Ceiling mounted with 360-degree coverage area. Provide pattern masking kits in increments of 60-degrees to mask regions where coverage is not desired. Masking kits shall be as manufactured by the motion sensor manufacturer.
  3. Minimum 30-foot coverage radius detection range when mounted at approximately 12 feet above the floor.
  4. Designed to be mounted between 8 feet to 25 feet above the floor.
  5. Options for surface-mount or flush-mount installation.
  6. Anti-mask technology to detect attempts to mask or block the sensor.
  7. Mirror optics
  8. Digitally adjustable microwave thresholds.
  9. Self-test capability to periodically test itself and report trouble conditions.
  10. Fluorescent light interference filter and white light guard
  11. Bidirectional temperature compensation

12. Built-in walk test functionality
  13. Power Requirements: 9 VDC to 15 VDC, fully compatible with the ACS alarm control panel. Provide auxiliary power supplies and expansion as required to power and monitor all motion sensors.
  14. Operating temperature: 32 degrees to 130 degrees Fahrenheit.
  15. Relative humidity: 5% to 95% non-condensing
  16. Protection Rating: IP30
- C. The ceiling mounted Intrusion Motion Sensor shall be as manufactured by Honeywell DT8360CM, Bosch, DSC, DMP, Interlogix, or approved equal.

#### 2.15 LIFE SAFETY

- A. Access Control System shall be connected to and integrated with the fire alarm system through coordination between the Security Contractor and the Fire Alarm Contractor. Coordinate with the Fire Alarm Contractor to provide relay connections from the Fire Alarm System to each Access Control System control board for automatically unlocking designated doors upon activation of the Fire Alarm.
- B. All access-controlled doors in the pathway of building egress shall release as required by life safety code. If doors are not required by life safety code to open, they shall remain locked. Refer to the Architect's door schedule for indication of fail-safe and fail-secure electrified locksets.

### PART 3 - EXECUTION

#### 3.1 INSPECTION AND PREPARATION WORK

- A. The Contractor shall examine the conditions under which the system installation is to be performed and notify the Owner's Representative or Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.
- B. Review all areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other work that penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

#### 3.2 INSTALLATION

- A. Install materials and equipment in accordance with manufacturer's printed instructions to comply with governing regulations and industry standards applicable to the work and as shown on approved Shop Drawings.
- B. Arrange and mount all equipment and materials in a manner acceptable to the Design Professional and Owner.
- C. Coordinate with the Owner all programming for access control privileges, control restriction, normal operations, off hours and holiday schedules, report generation, badging configuration and information and pin number generation before Final Acceptance. Make minor adjustments at no

cost to the Owner during the warranty period's two routine inspection periods as outlined in Section 280500.

- D. Installation shall conform to the basic guidelines:
1. Use of approved wire, cable, raceways, wiring, devices, hangers, supports, and fastening devices.
  2. Separation of high and low voltage wiring is required throughout the installation.
  3. All wiring shall be thoroughly tested for grounds and opens before final connection.
- E. Conduit shall be provided for risers. Horizontal wiring shall run without conduit unless required by code, see - QUALITY ASSURANCE. All power wiring over 48V shall be in metallic conduit. The maximum conduit fill shall not exceed 40% of rated capacity. Refer to NFPA 70-NEC for additional requirements.
- F. Cabling and Wire Requirements:
1. Refer to Section 280500 for all raceway, surge protection, and wiring requirements.
  2. The individual systems low voltage cabling conduit/raceway junction boxes and enclosures shall be separate from all electric power cabling.
  3. The minimum low voltage input/output cabling for Access Control System shall be #18 AWG unless specifically specified otherwise on the Contract Drawings. All cabling shall be jacketed. The systems cabling shall meet the requirements of NFPA 70/NEC Articles 725, 760 and 800 as applicable for each type of system specified.
  4. The minimum bend radius of all conduits provided shall be 6 inches. Provide and maintain pull strings/tapes/ropes in all conduits for future installation of additional cabling.
  5. All pull strings installed or placed in conduits that already contain, or that will contain system cabling, shall be able to be removed from the conduit without causing any damage to the cabling already contained with same conduit(s).
- G. Junction Boxes, Enclosures/Cabinets, Equipment Racks:
1. The equipment enclosures shall be installed at approved locations and be typically ventilated as required to maintain the environmental conditions specified by the electronic equipment manufacturers.
  2. All junction boxes and pull boxes shall be labeled. The box label shall state the system and use of cabling. The labeling shall be made with markers which are indelible when and after in contact with water and oil.
  3. Each box and enclosure shall contain a cabling and wiring log identifying all cabling accessible whether it is connected or is passing by.
  4. Refer to other sections of this Specification for additional requirements.
- H. Grounding and Surge Protection:
1. Provide single point grounding of the individual systems as recommended by IEEE and system manufacturers. Provide all cabling, bonding and insulation materials as required. Provide surge protection and clamping for all circuits. Coordinate all grounding, surge protection and manufacturers.

2. Coordinate grounding requirements with other trades and contractors to preclude closing of ground loops via peripheral equipment supplied from different electrical power sources. Provide isolation transformers and other equipment as required.

3.3 SPECIAL TOOLS, EQUIPMENT AND MATERIALS

- A. The Contractor shall deliver to the Owner's Representative all special tools, equipment, and materials necessary to maintain the system provided under this Contract.
- B. Contractor shall be required to perform complete testing and verification of the following:
  1. Card reader maximum access time shall be 0.75 seconds under all system loads.
- C. Refer to Section 28 05 10 for additional requirements.

3.4 AS-BUILTS

- A. Refer to Section 28 05 10.

3.5 SUBMITTALS

- A. Refer to Sections 28 05 00 and 28 05 10.

3.6 TRAINING

- A. Refer to Section 28 05 10.

END OF SECTION 28 13 00

**SECTION 281523 - SECURITY INTERCOM SYSTEM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to requirements of this Section.
- B. Refer to all Contract Drawings and specification sections listed in Section 280500 and 280510 for additional requirements.
- C. Refer to Division 26 and 27 and the Electrical drawings for coordination requirements for power and infrastructure.

1.2 DESCRIPTION OF WORK

- A. Provide Security Intercom System as shown on the Contract Drawings. The Intercom System integration shall include duplex voice communication between the master intercom stations and all substations.
- B. Site wide integration shall include Internet Protocol (IP) via the security network.
- C. Provide integration with the Access Control and Intrusion Detection System as shown on the Drawings and as specified in Specifications Section 281300. Users shall have the ability to remotely unlock a door associated with an intercom substation by utilizing a button on the master intercom station.
- D. The Intercom System shall include multiple voice channels/paths as required for simultaneous operation of all master intercom stations provided under this contract in conjunction with each locally controlled area.
- E. The work provided by the Contractor shall include the following:
  - 1. Provide new audio-only intercom substations as shown on the Contract Drawings, including backboxes, conduits, cabling, accessories, configuration, and integration.
  - 2. Provide new audio and video intercom substations as shown on the Contract Drawings, including backboxes, conduits, cabling, accessories, configuration, and integration.
  - 3. Provide new master intercom as shown on the Contract Drawings, including backboxes, conduits, cabling, accessories, configuration, and integration.
- F. Provide coordination with other trades and contractors as required for a complete, functional and trouble-free Intercom System.
- G. Provide weather proof intercom sub-stations mounted on pedestals located at vehicle gates as outlined on the Contract Drawings.
- H. Provide all labor, materials, equipment, testing and services necessary for and incidental to furnishing and installing intercom system. Provide power supplies, audio power amplifiers, backboxes and all required system accessories. Provide cabling runs, as shown on Contract

Drawings. Provide cable connector modules, weatherproof splice bodies and any appurtenances required for a fully functional system.

- I. Coordinate cabling, system components and their arrangements electrically and mechanically.
- J. Provide interface to the Access Control and Intrusion Detection System.
- K. Provide line fault indication for all circuits.

### 1.3 SYSTEM OPERATION

#### A. Intercom Master Station General Operation:

- 1. Master stations, through their command functions, to have the ability to:
  - a. Answer calls.
  - b. Place calls.
  - c. Monitor intercom substations.
  - d. Adjust station volume level.
  - e. Adjust display back lighting.
  - f. Select 12 or 24-hour clock display.
  - g. Remotely release each door associated with an intercom substation.
- 2. Provide for volume adjustment of master station and intercom levels shall be controlled during communications. Each station's volume level shall be independently software-controlled. Level settings shall remain in effect until modified by a future adjustment.
- 3. Master stations shall include the ability to be placed in an unmanned mode which automatically routes all of the associated call handling functions to a pre-defined secondary master station.
- 4. The system shall automatically release the speech path if dialing is not completed within a pre-programmed time period, typically five seconds.

#### B. Intercom Substation General Operation:

- 1. Depressing an intercom station's call push-button shall place a call request in the queue of the master station or stations assigned to receive that station's calls. Calls shall be queued in order of priority level associated with the intercom station and time the call was placed.
- 2. Calls not answered within a pre-programmed time shall place a secondary call request to an assigned master station.

#### C. Call answering at an intercom master station shall provide for the following:

- 1. Intercom master stations shall be able to answer the top call request in its queue by depressing the answer function key. At the completion of the call, the end call function key shall close the communication link and remove the call from the queue.

2. Subsequent calls may be similarly handled for the remaining calls in the queue.
3. Queued calls may be answered out of sequence by scrolling through the queue to the desired call. The selected call to flash on the display and shall be answered by depressing the 'Enter' key. 'End' key shall close the communication link, remove the call from the queue and return the master station display to the top of the queue.
4. A call that is currently connected to a master station shall display that the call is connected, the type of device connected, and the identity of the connected device.

D. Voice Communication shall provide for the following:

1. Telephone handset voice communication between intercom master stations shall be full duplex.
2. Open voice communications between intercom master stations shall be automatically switched half duplex with press-to-talk override.
3. Voice communications between intercom master stations and intercom stations shall be automatically switched half duplex with press-to-talk override.

E. Station monitoring shall provide for the following:

1. Master stations shall be able to monitor an individual intercom station or a pre-defined group of intercom stations.
2. System shall permit establishing as many station monitor groups as there are unused station ID numbers.
3. Each master station shall individually control the rate at which stations in the monitor group are sequenced through.

#### 1.4 FUNCTIONAL REQUIREMENTS

- A. System shall be capable of assigning station and group numbers within a minimum range of 1 to 500.
- B. System shall be capable of assigning an alphanumeric description for each device, group, zone, etc. with a minimum of 12 characters and spaces.
- C. All intercom station field wiring shall be supervised by monitoring device connectivity.
- D. All system boards shall include self-diagnostic functions for complete operational and communication testing.
- E. All system boards and devices shall be able to be inserted or removed from service while the system is fully operational. Other system activity not directly related to the board insertion or removal to not be affected.
- F. System diagnostics shall include the ability to test system communications and devices from the service, administration, and control computer.
- G. System shall include the ability to make on-line changes to the system configuration.

- H. System shall include logging functions for system activity and system maintenance.
- I. System shall include the ability to print, through an optional printer, activity and maintenance logs.
- J. On-line factory support shall be available through a modem connection to the service, administration and control computer.

#### 1.5 ELECTRICAL POWER REQUIREMENTS

- A. Provide all power as required. Coordinate all power and infrastructure requirements with the Division 26 Contractor.

#### 1.6 QUALIFICATIONS

- A. Contractor shall be qualified and certified by the manufacturer prior to installation and programming.

#### 1.7 QUALITY CONTROL

- A. Intercom System components shall meet the requirements of all applicable codes and standards. All equipment shall be of maximum-security correctional grade.
- B. The Contractor shall strictly adhere to the installation instructions provided by the system manufacturer and shall provide certification reports from the manufacturer's Representative that all installation instructions have been satisfactorily complied with.
- C. All equipment shall be Underwriters Laboratory/CSA listed.

#### 1.8 RELIABILITY

- A. Provide Intercom System with mean time before/between failure of minimum 36,000 hours.

### PART 2 - PRODUCTS

#### 2.1 VIDEO INTERCOM SUBSTATIONS

- A. Video Intercom substations shall be tamperproof and weatherproof, security grade, vandalproof, single button intercom stations, designed for surface-mounting on recessed back boxes. Stations shall be ruggedly constructed and resistant to damage from soil and sprays.
- B. Each video intercom substation shall incorporate an internal loudspeaker, microphone preamplifier, camera, LED illuminator, and function multiplexing circuitry. One pushbutton shall be provided on each station. Pushbuttons shall be software assignable for placement of call requests.
- C. All video intercom substation functions shall be transmitted over one Cat-6a cable.
- D. Powered by 802.3af Power over Ethernet.

- E. All video intercom stations shall include relay outputs for integration with the Access Control System for remote door unlock upon activation by an associated master intercom station. Provide cabling and integration.
- F. All video intercom substations shall be SIP 2.0 compliant.
- G. Each button shall be programmable, through the system, to call the master stations or to access any specific group function, e.g., group call, alarm call, etc.
- H. All video intercom substations shall include a minimum 1-megapixel color video camera with vertical angle adjustment to optimize the view based on the mounting height and local scene dimensions.
- I. Substation audio and video outputs shall be ONVIF Profile S compliant.
- J. The video intercom substations shall be as manufactured by Aiphone model IX-DV, or approved equal.

## 2.2 DESKTOP HANDSET MASTER VIDEO INTERCOM STATIONS

- A. Provide handset master video intercom stations meeting all of the following requirements at minimum:
  - 1. Fully compatible with the audio-only and video intercom substations to be fully functional with all intercom substations in each master intercom's jurisdiction.
  - 2. 7" color LCD touchscreen.
  - 3. SIP 2.0 compliant.
  - 4. ONVIF Profile S compliant.
  - 5. Multi-angled desk stand.
  - 6. 802.3af PoE powered
  - 7. Handset with speaker and microphone.
  - 8. Integral speaker and microphone for optional hands-free operation
  - 9. Line supervision with scheduled device check to monitor the associated intercom substations.
  - 10. As manufactured by the same manufacturer as the intercom substations.
- B. The desktop handset master video intercom stations shall be as manufactured by Aiphone model IX-MV7-H, or approved equal.

## 2.3 POWER SUPPLIES

- A. All intercom substations and master intercom stations shall be powered by Power over Ethernet. Coordinate with the Owner for connections to PoE network switches.

2.4 ADMINISTRATOR SOFTWARE

- A. All intercom substations and master stations shall be configurable via the manufacturer's configuration software for batch programming.
- B. Provide all software, configuration, settings templates, association, and integration.

2.5 INTERCOM CABLE

- A. Refer to Division 27 for Category-6A cabling requirements.

2.6 CATEGORY-6A PATCH PANELS

- A. Refer to Division 27 for Category-6A patch panel requirements.

**PART 3 - EXECUTION**

3.1 ZONING AND FINAL PROGRAMMING

- A. Installation shall conform to all applicable codes and standards and the requirements of the manufacturer. All intercom sub-stations shall be flush mounted at each location shown on the Contract Drawings.
- B. The Contractor shall provide system programming to enable system functions as described. Coordinate specific program requirements with the Owner.
- C. Provide level control adjustments to optimize volume levels for each substation and master station based on the local environment for each.

3.2 VERIFICATION OF OPERATION

- A. Contractor shall verify all intercom, signaling and programming capabilities described herein. The following capabilities shall be verified:
  - 1. All call functions, as required.
  - 2. Group call functions, as required.
  - 3. Alarm call functions, as required.
  - 4. Auto callback functions.
  - 5. Conference call functions, as required.
  - 6. Restricted access capability.
  - 7. Proper function and programming of substations.
  - 8. Proper function of system programming.
  - 9. Proper system programming as directed by the Owner and Design Professional.
  - 10. No hum, buzz, or objectionable distortion in system.
  - 11. Fast, uniform, repeatable calls, call-ins, and registration of substations.

12. Minimum 75 dBA on all master stations from all substations at earpieces.
13. Maximum integration response time of one (1) second, from any substation notification.
14. Maximum intercom switching time for push-to-talk less than 330 milliseconds.
15. All system equipment to comply with the radiation limits for Class A digital devices of FCC Rules Part 15, Subpart B.
16. Proper system programming as directed by the Owner and Design Professional.

### 3.3 TRAINING

- A. Manufacturers shall be responsible for providing minimum training by authorized system installers/representatives to the Owner's personnel in compliance with Section 280510.

END OF SECTION 281523

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**SECTION 282300 – VIDEO SURVEILLANCE SYSTEM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Specification.
- B. Refer to all Contract Drawings and Specifications listed in Section 280500 for additional requirements.
- C. Refer to Divisions 26 and 27 Specifications for coordination information.

1.2 COORDINATION

- A. Work shall be coordinated with all trades having related work on site including but not limited to general, building, structural, civil, site, landscape, mechanical, electrical, fire alarm, fire protection, and HVAC.

1.3 SYSTEM DESCRIPTION

- A. A new Internet Protocol (IP) based Video Surveillance System (VSS) shall be provided as shown on the Contract Documents.
- B. The IP VSS shall use security grade IP Video Surveillance cameras.
- C. All video workstation / video playback station / video review station computers communications for the IP Video Surveillance cameras shall be transmitted by an Ethernet based IP network.
- D. All video surveillance workstations connected to the network shall be capable of displaying both live and recorded video from all cameras according to Owner defined permissions.
- E. The system shall be capable of providing both single camera and multiplexed video display on any viewing stations.
- F. The system shall be capable of providing event driven or call-up video switching.
- G. The system shall record all cameras on the network.
- H. The system shall be designed to provide all functions typically found in a traditional video surveillance system without requiring a hardware matrix switch.
- I. The system shall be capable of being controlled via a map-based Graphical User Interface (GUI). The GUI will allow the user to select cameras by navigating through a map of the facility. Camera icons will indicate the location of each camera. These features shall not be required to be configured by this Contractor, but rather shall be configurable by the Owner in the future. These features shall be able to be enabled in the future without any additional cost to the Owner.
- J. The VSS shall be capable of integrating with an access control system (ACS) to allow easy movement between control system functions and video surveillance functions.

- K. The system shall be designed to permit the future expansion of the system with minimal modification to the system programming or configuration. The Owner shall be capable of adding cameras, viewing computers, or video recording servers by connecting these devices to the network and performing user level device configuration.
- L. The system shall be able to be fully integrated with the Owner's existing VSS in the County for monitoring and management. The new and existing VSS's shall form a single unified system using the existing and new LAN connections.

#### 1.4 DESCRIPTION OF WORK

- A. Provide materials, labor, equipment and service necessary for a complete IP based video surveillance and recording system as described herein including: cameras, housings, mounts, cables, network video recording/storage/retrieval system, and appurtenances. The network video monitoring system is existing to be reused.
- B. Prior to beginning work, the Contractor shall submit phasing plan for approval, to provide minimal downtime of existing VSS's during switchover.
- C. Refer to PART 2 for information on cameras, lenses, and mounting. Camera aim, adjusting and exact mounting location are the responsibility of the Contractor. The Contractor shall provide complete surveillance of the areas as intended by the "T" Contract Drawings.
- D. Contractor shall demonstrate camera views to the Owner prior to permanent mounting for all cameras using a monitor and recommended camera/lens combination. Lens combinations are recommendations only. The Contractor shall make any needed camera focus/lens adjustments at no additional cost to the Owner.
- E. Provide all software and software licenses required for fully functional system.
- F. Cameras shall be provided for remote observations of critical points.
- G. Provide viewing stations at the location indicated on the Contract Drawings.
- H. All cameras shall be able to be displayed for cursory review at the video surveillance viewing stations. cursory review shall be defined as multiplexed/split screen display for video surveillance cameras. Other scenes and arrangements of camera views shall be able to be displayed for the operator to focus on events which require his/her acknowledgment and/or decision.
- I. The system shall be integrated with other Security systems for event-based alarm call-up functionality. Typically, the call-up functions shall be initiated through interfacing of video surveillance system with intercoms, access control alarms, and other systems.
- J. The video surveillance system shall include all hardware and software required for automatic and manual enabling of PTZ camera preset zones and motion detection, or video surveillance scanning modes.
- K. Network video recording equipment shall be rack-mounted in designated equipment racks as shown on the Contract Drawings.

- L. Coordinate with the Owner for network configuration as required for proper system function and to connect the new buildings' video surveillance network to the Owner's existing video surveillance network.

#### 1.5 RELATED WORK

- A. In addition to work described above, the Work shall include, but not necessarily be limited to, the following:
  - 1. Equipment identification as specified elsewhere.
  - 2. Providing all cabling, conduit and connections as required and reusing existing infrastructure as available for complete and functional systems.
  - 3. Providing 120 VAC and low voltage power as required for all equipment provided under this contract.
  - 4. Assembling equipment furnished disassembled in accordance with manufacturer's recommendations.

#### 1.6 COOPERATION WITH OTHER TRADES

- A. The Contractor shall coordinate the work of this section as required to ensure that the entire work of this project shall be carried out in an orderly, complete, and coordinated fashion.

#### 1.7 SUBMITTALS

- A. General Requirements
  - 1. Submittals shall be made in accordance with General Conditions and the Division 28 requirements detailed in sections 280500 and 280510.
- B. Specific Requirements
  - 1. Submit catalog cuts for each piece of equipment, including but not limited to: cameras, lenses, enclosures, mounting brackets, viewing workstations, monitors, video management system software, recorders, etc.
  - 2. Submit plan drawings showing location, mounting, and field of view of each camera.
  - 3. Submit point-to-point wiring diagram for video surveillance system including grounding of all system components.
  - 4. Submit equipment rack details including equipment mounting, wire management, and installation in the equipment room.
  - 5. Refer to Section 280510 for additional requirements.

#### 1.8 RELIABILITY

- A. All video surveillance system components shall have mean time before/between failure of at minimum 36,000 hours.

## PART 2 - PRODUCTS

### 2.1 OVERVIEW

- A. The devices described herein are intended to provide a reference to the Video Surveillance System and are to be installed as shown on the Contract Drawings and in accordance with the manufacturers' recommendations and code requirements.
- B. Certain devices described may not be applicable to all systems. All devices required to complete the installation may not be described. It shall be the responsibility of the Contractor to provide a complete working system.
- C. All system components shall be approved for the function they will perform. Devices that must be modified or are not UL-listed will not be approved.

### 2.2 IP CAMERA TYPE ABBREVIATION DEFINITIONS

- A. All camera types shall use abbreviations taking the form “#XY”, where:
  - 1. # = resolution in megapixels – 12MP, 6MP, 5MP, or 2MP
  - 2. X = environmental rating – ‘E’ for outdoor environmental or ‘I’ for indoor
  - 3. Y = camera form factor – ‘D’ for dome, ‘P’ for panoramic multi-imager, or ‘H’ for hemispheric (fisheye)
- B. Refer to the camera types below and the camera schedule below for additional details and requirements.

### 2.3 IP FIXED CAMERAS – TYPES “5ID” AND “5ED”

- A. Provide IP fixed vandal-resistant camera that meets the following performance reliability and operational requirements at a minimum:
  - 1. Form Factor: IK10 rated vandal resistant mini dome
  - 2. Imager: minimum 1/2.7”
  - 3. Resolution: minimum 5MP (2592x1944) at 30ips
  - 4. Compression: H.264 and H.265
  - 5. Minimum streaming capability: minimum two simultaneous independently configurable H.264 or H.265 streams – one at full resolution and 15ips, one at VGA resolution and 15ips. Configurable unicast and/or multicast.
  - 6. Day/Night Operation: Automatic infrared cut filter
  - 7. Built-in Infrared Illuminators: Yes
  - 8. Wide Dynamic Range (WDR): Yes – 120 dB
  - 9. Infrared Illuminators: Yes – built-in
  - 10. Usable Picture at: 0.13 lux color, 0.0 lux (IR on)

11. Lens: minimum 3.6mm to 8mm varifocal
  12. Automatic Gain Control, Backlight Compensation: Yes
  13. Motorized Focus and Zoom: Yes – remote and local activation
  14. Motion Detection: Built-in, configurable
  15. Standards Compliance: ONVIF profiles S, G,
  16. Power: 802.3af Power over Ethernet (PoE)
  17. Outdoor Rated: Exterior IP66 rated where indicated
  18. Operating Temperature: -40° C to +55° C for exterior model, and 0° C to +50° C for interior model
  19. Fully compatible with the Video Management System
- B. Cameras shall be as manufactured by Axis models P3247-LV and P3247-LVE, Hanwha models XND-8081VZ and XNV-8081Z, or approved equal. Provide all required mounts and accessories.
- C. Refer to Section 2.8 VIDEO SURVEILLANCE CAMERA SCHEDULE.

#### 2.4IP FIXED CAMERAS – TYPE “2ID” AND “2ED”

- A. Provide IP fixed vandal-resistant camera that meets the following performance reliability and operational requirements at a minimum:
1. Form Factor: IK10 rated vandal resistant mini dome
  2. Imager: minimum 1/2.8”
  3. Resolution: minimum 2MP (1920x1080) at 30ips
  4. Compression: H.264 and H.265
  5. Minimum streaming capability: minimum two simultaneous independently configurable H.264 or H.265 streams – one at full resolution and 15ips, one at VGA resolution and 15ips. Configurable unicast and/or multicast.
  6. Day/Night Operation: Automatic infrared cut filter
  7. Built-in Infrared Illuminators: Yes
  8. Wide Dynamic Range (WDR): Yes – 120 dB
  9. Infrared Illuminators: Yes – built-in
  10. Usable Picture at: 0.1 lux color, 0.0 lux (IR on)
  11. Lens: minimum 3.4mm to 8.9mm varifocal
  12. Automatic Gain Control, Backlight Compensation: Yes
  13. Motorized Focus and Zoom: Yes – remote and local activation
  14. Motion Detection: Built-in, configurable

15. Standards Compliance: ONVIF profiles S, G,
  16. Power: 802.3af Power over Ethernet (PoE)
  17. Outdoor Rated: Exterior IP66 rated where indicated
  18. Operating Temperature: -40° C to +55° C for exterior model, and 0° C to +50° C for interior model
  19. Fully compatible with the Video Management System
- B. Cameras shall be as manufactured by Axis models P3265-LV and P3265-LVE, Hanwha models XND-6081VZ and XNV-6081Z, or approved equal. Provide all required mounts and accessories.
- C. Refer to Section 2.8 VIDEO SURVEILLANCE CAMERA SCHEDULE.

#### 2.5IP FIXED CAMERAS – TYPE “12IH” AND “12EH”

- A. Provide fixed IP vandal-resistant camera that meets the following performance reliability and operational requirements at a minimum:
1. Form Factor: IK10 rated vandal resistant hemispheric (fisheye)
  2. Imager: minimum 1/2.7”
  3. Resolution: minimum 12MP at minimum 12.5ips
  4. Compression: minimum H.264
  5. Minimum streaming capability: minimum two simultaneous independently configurable H.264 streams – one overview at full resolution and 12ips, one overview at VGA resolution and 12ips. Configurable unicast and/or multicast.
  6. Dewarping: Capability to support on-camera and on-client
  7. Day/Night Operation: Automatic infrared cut filter
  8. Built-in Infrared Illuminators: Yes
  9. Wide Dynamic Range (WDR): Yes – minimum 120 dB
  10. Usable Picture at: 0.39 lux color, 0.0 lux (IR on)
  11. Lens: fixed
  12. Automatic Gain Control, Backlight Compensation: Yes
  13. Motorized Focus and Zoom: Not required
  14. Motion Detection: Built-in, configurable
  15. Standards Compliance: ONVIF profile S, G, T
  16. Power: 802.3af Power over Ethernet (PoE)
  17. Outdoor Rated: Exterior IP67 rated where required

18. Operating Temperature: -40° C to +55° C for exterior model, and 0° C to +50° C for interior model
  19. Fully compatible with the Video Management System
- B. Cameras shall be as manufactured by Axis model M3058-PLVE, Hanwha XNF-9010RV, or approved equal. Provide all required mounts and accessories.
- C. Refer to Section 2.8 VIDEO SURVEILLANCE CAMERA SCHEDULE.

#### 2.6IP FIXED CAMERAS – TYPE “6IH” AND “6EH”

- A. Provide fixed IP vandal-resistant camera that meets the following performance reliability and operational requirements at a minimum:
1. Form Factor: IK10 rated vandal resistant hemispheric (fisheye)
  2. Imager: minimum 1/1.8”
  3. Resolution: minimum 6MP at minimum 30ips
  4. Compression: H.264 and H.265
  5. Minimum streaming capability: minimum two simultaneous independently configurable H.265 streams – one overview at full resolution and 15ips, one overview at VGA resolution and 15ips. Configurable unicast and/or multicast.
  6. Dewarping: Capability to support on-camera and on-client
  7. Day/Night Operation: Automatic infrared cut filter
  8. Built-in Infrared Illuminators: Yes
  9. Wide Dynamic Range (WDR): Yes – minimum 120 dB
  10. Usable Picture at: 0.16 lux color, 0.0 lux (IR on)
  11. Lens: fixed
  12. Automatic Gain Control, Backlight Compensation: Yes
  13. Motorized Focus and Zoom: Not required
  14. Motion Detection: Built-in, configurable
  15. Standards Compliance: ONVIF profile S, G
  16. Power: 802.3af Power over Ethernet (PoE)
  17. Outdoor Rated: Exterior IP67 rated where required
  18. Operating Temperature: -40° C to +55° C for exterior model, and 0° C to +50° C for interior model
  19. Fully compatible with the Video Management System

- B. Cameras shall be as manufactured by Axis model M3057-PLVE Mk II, Hanwha XNF-8010RV, or approved equal. Provide all required mounts and accessories.

2.7CAMERA TYPE DEFINITIONS –REFER TO CAMERA SCHEDULE A.

<b>Camera Type Number</b>	<b>Manufacturer and Model</b>
5ID	See item 2.3 above
5ED	See item 2.3 above
2ID	See item 2.4 above
2ED	See item 2.4 above
12IH	See item 2.5 above
12EH	See item 2.5 above
6IH	See item 2.6 above
6EH	See item 2.6 above

B.

<b>Camera Mount Type</b>	<b>Definition</b>
CLG	Ceiling Mount for the associated camera type.
WALL	Wall Mount for the associated camera type.
ARM	Wall Arm Mount for the associated camera type.
POLE	Pole mount for the associated camera type.
COLUMN	Column mount for the associated camera type.
PEND	Ceiling Pendent mount for the associated camera type.

2.8 VIDEO SURVEILLANCE CAMERA SCHEDULE

- A. The security contractor shall provide the cameras furnished and configured by the owner listed on the Contract Drawings and outlined in the following schedule.
- B. The following schedule does not relinquish the responsibility of the Contractor to provide all devices shown on the Contract Drawings. The schedule is to be used in conjunction with the Specifications and Contract Drawings. Any discrepancies shall be brought to the attention of the Project Manager and Design Professional.

Abbreviations Used In Camera Schedule:

“N/A” = Not Applicable

“WP” = Weatherproof

**VIDEO SURVEILLANCE CAMERA SCHEDULE**

<b>Camera Number</b>	<b>Location</b>	<b>Type Number</b>	<b>Mount Type</b>
1.0.01	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.02	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.03	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.04	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.05	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.06	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.07	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.08	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.09	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.0.10	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.0.11	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.0.12	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.0.13	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.0.14	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.15	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.16	Building 1 Level 0 - Lobby 1001	6IH	CLG
1.0.17	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.18	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.19	Building 1 Level 0 - Lobby 1001	2ID	CLG
1.0.20	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.21	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.22	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.23	Building 1 Level 0 - Parking Garage	5ED	CLG
1.0.24	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.0.25	Building 1 Level 0 - Vehicle Gates	5ED	CLG
1.1.01	Building 1 Level 1 - Cafe 1110	2ID	CLG
1.1.02	Building 1 Level 1 - Entrance	5ID	CLG
1.1.03	Building 1 Level 1 - Plaza	5ID	WALL
1.1.04	Building 1 Level 1 - Cafe 1110	2ID	CLG
1.1.05	Building 1 Level 1 - Cafe 1110	5ID	CLG
1.1.06	Building 1 Level 1 - Cafe 1110	2ID	CLG
1.1.07	Building 1 Level 1 - Lobby 1100	2ID	CLG
1.1.08	Building 1 Level 1 - Plaza	5ED	COLUMN

<b>Camera Number</b>	<b>Location</b>	<b>Type Number</b>	<b>Mount Type</b>
1.1.09	Building 1 Level 1 - Plaza	5ED	COLUMN
1.1.10	Building 1 Level 1 - Plaza	2ED	COLUMN
1.1.11	Building 1 Level 1 - Lobby 1100	2ID	CLG
1.1.12	Building 1 Level 1 - Lobby 1100	2ID	CLG
1.1.13	Building 1 Level 1 - Lobby 1100	2ID	CLG
1.1.14	Building 1 Level 1 - Lobby 1100	5ID	CLG
1.1.15	Building 1 Level 1 - Lobby 1100	5ID	CLG
1.1.16	Building 1 Level 1 - Lobby 1100	5ID	CLG
1.1.17	Building 1 Level 1 - Lobby 1100	5ID	CLG
1.2.01	Building 1 Level 2 - Elevator Lobby 1201	2ID	CLG
1.2.02	Building 1 Level 2 - Elevator Lobby 1201	2ID	CLG
1.2.03	Building 1 Level 2 - Elevator Lobby 1201	2ID	CLG
1.2.04	Building 1 Level 2 - Elevator Lobby 1201	2ID	CLG
1.2.05	Building 1 Level 2 - Elevator Lobby 1201	2ID	CLG
1.3.01	Building 1 Level 3 - Elevator Lobby 1301	2ID	CLG
1.3.02	Building 1 Level 3 - Elevator Lobby 1301	2ID	CLG
1.3.03	Building 1 Level 3 - Elevator Lobby 1301	2ID	CLG
1.4.01	Building 1 Level 4 - Elevator Lobby 1401	2ID	CLG
1.4.02	Building 1 Level 4 - Elevator Lobby 1401	2ID	CLG
1.4.03	Building 1 Level 4 - Elevator Lobby 1401	2ID	CLG
1.5.01	Building 1 Level 5 - Elevator Lobby 1501	2ID	CLG
1.5.02	Building 1 Level 5 - Elevator Lobby 1501	2ID	CLG
1.5.03	Building 1 Level 5 - Elevator Lobby 1501	2ID	CLG
1.6.01	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.02	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.03	Building 1 Level 6 - Roof Exterior	2ED	ARM
1.6.04	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.05	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.06	Building 1 Level 6 - Roof Exterior	2ED	ARM
1.6.07	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.08	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.09	Building 1 Level 6 - Roof Exterior	5ED	ARM
1.6.10	Building 1 Level 6 - Roof Exterior	2ED	ARM
1.6.11	Building 1 Level 6 - Roof Exterior	5ED	ARM
1.6.12	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.13	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.14	Building 1 Level 6 - Roof Exterior	5ED	WALL
1.6.15	Building 1 Level 6 - Roof Exterior	2ED	ARM
1.6.16	Building 1 Level 6 - Vestibule 1609	6IH	CLG

<b>Camera Number</b>	<b>Location</b>	<b>Type Number</b>	<b>Mount Type</b>
1.6.17	Building 1 Level 6 - Rooftop Lobby 1614	6IH	CLG
1.E.01	Building 1 - Elevator 01	6IH	CLG
1.E.02	Building 1 - Elevator 02	6IH	CLG
1.R.01	Building 1 Roof - Rooftop Exterior	2ED	ARM
1.R.02	Building 1 Roof - Rooftop Exterior	5ED	ARM
1.R.03	Building 1 Roof - Rooftop Exterior	2ED	ARM
1.R.04	Building 1 Roof - Rooftop Exterior	5ED	ARM
2.0.01	Building 2 Level 0 - Mail 2010	2ID	CLG
2.0.02	Building 2 Level 0 - Mail 2010	2ED	CLG
2.0.03	Building 2 Level 0 - Lobby 2015	5ID	CLG
2.0.04	Building 2 Level 0 - Lobby 2015	2ID	CLG
2.0.05	Building 2 Level 0 - Lobby 2015	5ID	CLG
2.0.06	Building 2 Level 0 - Corridor CR200.1	2ID	CLG
2.0.07	Building 2 Level 0 - Lobby 2001	5ID	CLG
2.0.08	Building 2 Level 0 - Lobby 2001	5ID	CLG
2.0.09	Building 2 Level 0 - Lobby 2001	2ID	CLG
2.0.10	Building 2 Level 0 - Lobby 2001	5ID	CLG
2.0.11	Building 2 Level 0 - Lobby 2001	5ID	CLG
2.0.12	Building 2 Level 0 - Lobby 2001	2ID	CLG
2.0.13	Building 2 Level 0 - Lobby 2001	2ID	CLG
2.0.14	Building 2 Level 0 - Lobby 2001	2ID	CLG
2.1.01	Building 2 Level 1 - Plaza	5ED	WALL
2.1.02	Building 2 Level 1 - Elevator Lobby 2101	5ID	CLG
2.1.03	Building 2 Level 1 - Elevator Lobby 2101	2ID	CLG
2.1.04	Building 2 Level 1 - Elevator Lobby 2101	5ID	CLG
2.1.05	Building 2 Level 1 - Passage 2108	2ID	CLG
2.1.06	Building 2 Level 1 - Elevator Lobby 2101	5ID	CLG
2.1.07	Building 2 Level 1 - Corridor	2ID	CLG
2.1.08	Building 2 Level 1 - Waiting 2130	6IH	CLG
2.1.09	Building 2 Level 1 - Corridor	2ID	CLG
2.1.10	Building 2 Level 1 - Plaza	5ED	WALL
2.1.11	Building 2 Level 1 - Plaza	5ED	COLUMN
2.1.12	Building 2 Level 1 - Plaza	2ED	ARM
2.1.13	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.1.14	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.1.15	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.1.16	Building 2 Level 1 - Waiting 2110	2ID	CLG
2.1.17	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.1.18	Building 2 Level 1 - Waiting 2110	5ID	CLG

<b>Camera Number</b>	<b>Location</b>	<b>Type Number</b>	<b>Mount Type</b>
2.1.19	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.1.20	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.1.21	Building 2 Level 1 - Waiting 2110	5ID	CLG
2.2.01	Building 2 Level 2 - Cafe A 2222	5ID	CLG
2.2.02	Building 2 Level 2 - Cafe B 2223	5ID	CLG
2.2.03	Building 2 Level 2 - Corridor 2220	5ID	CLG
2.2.04	Building 2 Level 2 - Corridor 2220	2ID	CLG
2.2.05	Building 2 Level 2 - Corridor 2220	5ID	CLG
2.2.06	Building 2 Level 2 - Elevator Lobby 2201	2ID	CLG
2.2.07	Building 2 Level 2 - Elevator Lobby 2201	5ID	CLG
2.2.08	Building 2 Level 2 - Elevator Lobby 2201	2ID	CLG
2.2.09	Building 2 Level 2 - Passage 2208	2ID	CLG
2.2.10	Building 2 Level 2 - Elevator Lobby 2201	5ID	CLG
2.2.11	Building 2 Level 2 - Elevator Lobby 2201	2ID	CLG
2.2.12	Building 2 Level 2 - Elevator Lobby 2201	2ID	CLG
2.3.01	Building 2 Level 3 - Elevator Lobby 2301	5ID	CLG
2.3.02	Building 2 Level 3 - Elevator Lobby 2301	5ID	CLG
2.3.03	Building 2 Level 3 - Elevator Lobby 2301	5ID	CLG
2.3.04	Building 2 Level 3 - Elevator Lobby 2301	2ID	CLG
2.3.05	Building 2 Level 3 - Passage 2308	2ID	CLG
2.3.06	Building 2 Level 3 - Elevator Lobby 2301	5ID	CLG
2.4.01	Building 2 Level 4 - Elevator Lobby 2401	5ID	CLG
2.4.02	Building 2 Level 4 - Elevator Lobby 2401	2ID	CLG
2.4.03	Building 2 Level 4 - Passage 2408	2ID	CLG
2.4.04	Building 2 Level 4 - Elevator Lobby 2401	5ID	CLG
2.5.01	Building 2 Level 5 - Elevator Lobby 2501	5ID	CLG
2.5.02	Building 2 Level 5 - Elevator Lobby 2501	2ID	CLG
2.5.03	Building 2 Level 5 - Passage 2508	2ID	CLG
2.5.04	Building 2 Level 5 - Elevator Lobby 2501	5ID	CLG
2.6.01	Building 2 Level 6 - Elevator Lobby 2601	2ID	CLG
2.6.02	Building 2 Level 6 - Elevator Lobby 2601	5ID	CLG
2.6.03	Building 2 Level 6 - Elevator Lobby 2601	2ID	CLG
2.6.04	Building 2 Level 6 - Passage 2608	2ID	CLG
2.6.05	Building 2 Level 6 - Elevator Lobby 2601	5ID	CLG
2.7.01	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.02	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.03	Building 2 Level 7 - Roof Exterior	2ED	ARM
2.7.04	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.05	Building 2 Level 7 - Roof Exterior	5ED	WALL

<b>Camera Number</b>	<b>Location</b>	<b>Type Number</b>	<b>Mount Type</b>
2.7.06	Building 2 Level 7 - Roof Exterior	5ED	ARM
2.7.07	Building 2 Level 7 - Roof Exterior	2ED	ARM
2.7.08	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.09	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.10	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.11	Building 2 Level 7 - Roof Exterior	5ED	WALL
2.7.12	Building 2 Level 7 - Roof Exterior	2ED	ARM
2.7.13	Building 2 Level 7 - Roof Exterior	2ED	WALL
2.7.14	Building 2 Level 7 - Roof Exterior	5ED	ARM
2.7.15	Building 2 Level 7 - Vestibule	6IH	CLG
2.E.01	Building 2 - Elevator 03	6IH	CLG
2.E.02	Building 2 - Elevator 04	6IH	CLG
2.E.03	Building 2 - Elevator 05	6IH	CLG
2.R.01	Building 2 Roof - Rooftop Exterior	5ED	ARM
2.R.02	Building 2 Roof - Rooftop Exterior	5ED	ARM
2.R.03	Building 2 Roof - Rooftop Exterior	5ED	ARM
P.01	Site - Nearest to Building 1	5ED	POLE
P.02	Site - Nearest to Building 1	5ED	POLE
P.03	Site - Nearest to Building 1	5ED	COLUMN
P.04	Site - Nearest to Building 1	5ED	COLUMN
P.05	Site - Nearest to Building 1	5ED	COLUMN
P.06	Site - Nearest to Building 1	5ED	COLUMN
P.07	Site - Nearest to Building 1	5ED	COLUMN
P.08	Site - Nearest to Building 1	5ED	COLUMN
P.09	Site - Nearest to Building 1	5ED	COLUMN
P.10	Site - Nearest to Building 1	5ED	COLUMN
P.11	Site - Nearest to Building 1	5ED	COLUMN
P.12	Site - Nearest to Building 2	5ED	COLUMN
P.13	Site - Nearest to Building 2	5ED	COLUMN
P.14	Site - Nearest to Building 2	5ED	COLUMN
P.15	Site - Nearest to Building 2	5ED	COLUMN
P.16	Site - Nearest to Building 2	5ED	COLUMN
P.17	Site - Nearest to Building 2	5ED	COLUMN
P.18	Site - Nearest to Building 2	5ED	COLUMN
P.19	Site - Nearest to Building 2	5ED	COLUMN
P.20	Site - Nearest to Building 2	5ED	COLUMN
P.21	Site - Nearest to Building 2	5ED	COLUMN
P.22	Site - Nearest to Building 2	5ED	COLUMN
P.23	Site - Nearest to Building 2	5ED	POLE

<b>Camera Number</b>	<b>Location</b>	<b>Type Number</b>	<b>Mount Type</b>
P.24	Site - Nearest to Building 2	5ED	POLE
P.25	Site - Nearest to Building 2	5ED	COLUMN
P.26	Site - Nearest to Building 2	5ED	COLUMN
P.27	Site - Nearest to Building 2	2ED	CLG
P.28	Site - Nearest to Building 2	5ED	POLE
P.29	Site - Nearest to Building 2	5ED	POLE
P.30	Site - Nearest to Building 2	5ED	COLUMN
P.31	Site - Nearest to Building 2	5ED	COLUMN
P.32	Site - Nearest to Building 2	5ED	COLUMN
P.33	Site - Nearest to Building 2	5ED	COLUMN
P.34	Site - Nearest to Building 2	2ED	CLG
P.35	Site - Nearest to Building 2	5ED	COLUMN
P.36	Site - Nearest to Building 2	5ED	COLUMN
P.37	Site - Nearest to Building 2	5ED	COLUMN
P.38	Site - Nearest to Building 1	5ED	COLUMN
P.39	Site - Nearest to Building 1	5ED	COLUMN
P.40	Site - Nearest to Building 1	5ED	COLUMN
P.41	Site - Nearest to Building 1	5ED	COLUMN
P.42	Site - Nearest to Building 1	5ED	COLUMN
P.43	Site - Nearest to Building 1	5ED	COLUMN
P.44	Site - Nearest to Building 1	5ED	COLUMN
P.45	Site - Nearest to Building 1	5ED	COLUMN
P.46	Site - Nearest to Building 1	5ED	COLUMN
P.47	Site - Nearest to Building 1	5ED	POLE
P.48	Site - Nearest to Building 1	5ED	POLE
P.49	Site - Nearest to Building 1	5ED	COLUMN
P.50	Site - Nearest to Building 1	5ED	COLUMN
P.51	Site - Nearest to Building 1	5ED	COLUMN

2.9 24" DESKTOP MOUNTED LCD VIDEO MONITOR

- A. Provide desktop mounted LCD video monitors at each video surveillance workstation location as shown on the Contract Drawings for monitoring and managing the VSS.
- B. Desktop mounted LCD video monitors shall meet all of the following performance, reliability, and operational requirements at a minimum:
  - 1. 24" LED backlit LCD Display.
  - 2. Resolution: 1920x1080.
  - 3. Aspect Ratio: 16:9.

4. Brightness: at minimum 300 cd/m<sup>2</sup>.
5. Contrast Ratio: at minimum 5000:1.
6. Viewing Angle: at minimum 176°H 176°V.
7. At minimum one (1) HDMI or DisplayPort input to be compatible with the VSS workstation computer video outputs.
8. Built-in speakers.
9. Fully compatible with the associated VSS workstation computer for displaying the video management system.
10. Rated for Commercial use and at minimum 16 hours per day 7 days per week operation.

- C. Desktop mounted LCD video monitor shall be as manufactured by Sharp, Samsung, LG, NEC, or approved equal.

2.10 IP VIDEO SURVEILLANCE VIDEO MANAGEMENT, RECORDING, AND VIEWING SYSTEM

- A. The IP video surveillance Video Management, Recording, and viewing system shall be a combined software and hardware system. The system shall include all Servers, Computers, Network equipment and accessories required to for a fully functional IP-based video surveillance system.
- B. The system shall provide recording of all video surveillance IP cameras on the networked servers.
- C. The system shall provide viewing of live and recorded video on network workstations as shown on the construction documents.
- D. The system shall be designed to meet the video surveillance application of the Owner's security system.
- E. The system shall provide all common functions of a matrix switch based video surveillance system.
- F. The system shall be open-standards compliant and open architecture so as to support IP cameras, encoders, and clients from open-standards compliant manufacturers. At minimum, the system shall be ONVIF profile S compliant.
- G. The Contractor shall provide all required video surveillance equipment, network equipment, modules, power supplies, wiring, relays, etc., whether listed herein or not, to provide a perfectly operational system with no glitches, bugs or impediments which would otherwise detract from proper system operation. Contractor shall inform himself through thorough investigation of the manufacturers' requirements and meet all VSS monitoring, management and recording requirements as required by the Design Professional and the Owner.
- H. Provide an IP VSS management, recording, and viewing system shown on the Contract Drawings having the following features/characteristics:
  1. VSS Performance Requirements

- a. The system shall simultaneously provide the following features on all servers and network workstations without any video quality degradation or loss of frames:
  - 1) Video recording.
  - 2) Recorded video playback.
  - 3) Live video display.
  - 4) Multi-view (multiplexed) live video display.
  - 5) System / Camera Configuration Adjustments.
  - 6) Camera Selection.
  - 7) PTZ camera Control.
- b. Image Quality
  - 1) The system shall provide “clear picture” transmission and recording of all cameras.
  - 2) All video for each camera shall be transmitted to the video recording server without degradation of intelligence or color fidelity.
  - 3) The picture shall be free of distortion, pixilation, tearing, flicker, snow, ghosting, frame loss, pixel loss, and other forms of interference or degradation.
  - 4) The system shall produce live and recorded video acceptable to the Owner and the Design Professional.
- c. Video Recording
  - 1) All VSS cameras provided under this project shall be recorded continuously.
  - 2) The system shall be configured to provide recording of all cameras at minimum frame rate of 30 images per second (ips) at the maximum image resolution of each camera unless specifically noted otherwise.
  - 3) All cameras shall be configured to be recorded at each camera’s maximum image resolution unless specifically noted otherwise.
  - 4) The system shall also support recorded image resolution of:
    - a) 640 x 480 pixels
    - b) 1MP
    - c) 1.3MP
    - d) 2MP
    - e) 2.1MP
    - f) 3MP
    - g) 5MP

- h) 6MP
  - i) 12MP
  - j) All other resolutions as required to support all VSS cameras.
- d. Video Storage Capacity
  - 1) The System shall be configured to provide a minimum of 90 days of video storage retention for all new cameras.
  - 2) The Storage capacity shall be configured based on the following criteria for all cameras:
    - a) Each camera recorded at its maximum resolution
    - b) Fifteen (15) frames per second
    - c) 24x7x365 continuous recording.
    - d) Ninety (90) days storage retention
  - 3) The Contractor shall submit video bandwidth and storage calculations to show that all network links and recording servers shall have sufficient bandwidth, throughput to/from disk, and storage capacity.
- e. Live Video Display
  - 1) When viewing two or fewer simultaneous camera views, the system shall be configured to display all selected cameras at 15 FPS using the “high” video stream from each camera which shall be configured for each camera’s maximum image resolution.
  - 2) When viewing three or more simultaneous camera views, the system shall be configured to display all selected cameras at 15 FPS using the “low” video stream from each camera which shall be configured for 640x480 for each camera. The system shall be capable of displaying at minimum 25 simultaneous views with these settings.
  - 3) The system shall allow the user to select any camera to display in any location on any system monitor.
  - 4) The system shall be capable to display full screen live video on all system monitors simultaneously.
  - 5) The live video viewing client shall be capable of client-side dewarping of 180/360 cameras.
- f. Multiplexed Live Video Display
  - 1) The system shall be capable of displaying multiplexed video on all system monitors provided.
  - 2) The system shall be configured to provide a 5x5 multiplexed video on all system monitors simultaneously, with views as coordinated with the Owner

- 3) The system shall support at minimum the following multiplexed views by default:
    - a) 5x5.
    - b) 5x4
    - c) 4x4.
    - d) 3x3.
    - e) 2x2.
  - 4) The system shall support custom multiplexed screens of any quantity and orientation of camera displays up to the maximum quantity supported by the display workstation.
  - 5) The system shall support both programmed and user selected multiplexed screen.
  - 6) The system shall support an unlimited amount of programmed multiplexed views.
- g. Recorded Video Display
- 1) The system shall be capable of displaying recorded video on all system monitors without delay, video degradation, or loss of frames.
  - 2) The system shall be capable of displaying recorded video at the full recorded video frame rate and resolution at maximum image quality on each system workstation simultaneously without hesitation, pixilation, freezing, jumping, etc.
  - 3) The system shall be capable of displaying recorded video in a single camera screen or multiplexed view.
  - 4) The recorded video viewing client shall be capable of client-side dewarping of 180/360 cameras from full the recorded overall view.
- h. Recorded Video Export
- 1) The system shall be capable of exporting recorded video to CD, DVD, external hard drive, or USB drive.
  - 2) Supported file types shall be standards based, including minimum AVI and MOV.
- i. Duplicate image display
- 1) The system shall be capable of displaying recorded video from any single camera on up to (5) monitors simultaneously.
  - 2) The system shall be capable of displaying any selected multiplexed view on all monitors simultaneously.
  - 3) The system shall be cable of displaying any selected camera in a different multiplexed screen on each system monitors simultaneously.

2. System Components
  - a. Video Surveillance System Servers
    - 1) Refer to item 2.12 for additional server hardware requirements.
    - 2) The servers shall run the system software and control the entire building VSS.
    - 3) The servers shall provide the system management, control, logging, and recording functions.
    - 4) The contractor shall provide additional servers as needed to meet performance requirements and as required for overall system function.
    - 5) The contractor shall provide all storage devices required for full system function.
  - b. Video Viewing and Management Workstations
    - 1) Provide video workstations as shown on Contract Drawings.
    - 2) Viewing stations shall include as a minimum the following. Refer to Contract Drawings for quantity of monitors at each location.
      - a) One (1) network workstation.
      - b) One (1) 24" LCD monitor for camera video display for alarm call-up.
    - 3) The contractor shall provide any additional network workstations required to support monitor quantity. All workstations provided in a control room shall be configured to function as a single integrated unit.
    - 4) Refer to item 2.11 for additional workstation requirements.
  - c. Network Switches
    - 1) Coordinate with the Owner for all network switches and configuration required for the complete and fully functional VSS.
3. System Function
  - a. Menu Based Navigation
    - 1) The system shall provide pull down and tree-based menus to allow quick access to camera selection, multiplexed view display, and configuration screens.
  - b. Camera Selection
    - 1) The user shall select a camera for display by clicking on the camera's icon on the map or selecting the camera from an organized hierarchical tree.
    - 2) Selecting a camera shall also display any control option available.
    - 3) The system shall allow the user the option of hiding the rest of the graphical user interface to view the single camera video screen full screen.
  - c. Multiplexed View Selection

- 1) The user shall select multiplexed views by first selecting a monitor then selecting a preprogrammed view from a drop down menu or button bar.
  - 2) The user shall be capable of creating a custom multiplexed view by selecting a monitor and the cameras to be displayed.
  - 3) The system shall allow the user the option of hiding rest of the graphical user interface to view the multiplexed video screen full screen.
- d. Auto Camera Call-Up
- 1) The system shall be capable of allowing the user to assign any monitor or multiplexed view window for event driven automatic camera call-up. Configure automatic camera call-up for Security events including Access Control System door alarms and Intrusion Detection System motion alarms.
  - 2) Events capabilities shall include the following:
    - a) Door control.
    - b) Intercom call.
    - c) Intrusion Detection System Alarm.
    - d) Camera motion detection.
  - 3) The call-up monitor or view pane shall be capable of automatically switching to the programmed camera when an event is registered.
  - 4) The system shall be capable of supporting several call-up monitors and assigning camera to different monitors.
  - 5) The user shall be able to disable camera call-up. The system shall display a status icon when camera call up is disabled.
- e. PTZ Camera Control
- 1) The system shall display PTZ camera controls when PTZ cameras are selected.
  - 2) The system shall provide mouse driven target selection controls and icon-based control.
  - 3) The following PTZ control icons shall be available:
    - a) Up.
    - b) Down.
    - c) Right.
    - d) Left.
    - e) Zoom in.
    - f) Zoom out.
    - g) Auto focus.

- 4) The system shall support presets views and auto panning.
  - 5) The system shall support auto-switching tours of groups of programmed system presets.
  - 6) Presets, auto panning, and tours shall be selected from a drop down menu.
  - 7) The system shall provide access to complete programming of menus embedded in the selected dome.
- f. Recorded Video Playback
- 1) The user shall access recorded video playback by selecting any camera.
  - 2) When a camera is the selected, the system shall display the option to view the recorded video.
  - 3) Selecting to enter the recorded video review mode will display a full set of video control icons and icons for starting search functions.
  - 4) The video review mode shall permit the review of single full screen or multiplex video with selectable synchronized or unsynchronized playback.
4. Additional Features
- a. Camera Labeling
- 1) Individual camera labeling and numbering with at minimum 16 characters as approved by the Owner. Coordinate with the Owner prior to final configuration of camera numbering and naming.
  - 2) The server's cameras, microphones and sensors shall be named. Cameras shall be setup as PTZ types as applicable and full descriptions shall be assigned.
- b. Individual camera indication of the following:
- 1) Alarm indication.
  - 2) Video loss.
  - 3) Date and time.
  - 4) Video motion detection
- c. Capability to support selectable recording modes including the following:
- 1) Continuous recording.
  - 2) Event recording.
  - 3) Sequential recording.
- d. Video search by the following categories:
- 1) Time.
  - 2) Date.

- 3) Location.
  - 4) Event.
  - 5) Motion.
  - 6) Camera.
- e. Post image processing with the following features:
- 1) Digital zoom.
  - 2) Image enhancement.
  - 3) Contrast.
  - 4) Brightness.
- f. Digital motion detection with the following user-selectable settings:
- 1) Zone size.
  - 2) Zone sensitivity.
  - 3) Number of pixels required to create an alarm condition.
- g. Remote camera configuration menus.
- h. Network recorder software shall support the following backup formats:
- 1) NAS.
  - 2) SAN
  - 3) CD-RW.
  - 4) DVD.
  - 5) USB external drive.
- i. The system shall be cable of displaying any selected camera in a different multiplexed screen on each system monitors simultaneously.
- j. The system shall be capable of supporting remote access of recorded and live video by any computer provided by the Owner over the security network.
- k. The new VSS shall be integrated with the Owner's existing VSS in the County to form a single unified VSS without requiring software or license upgrades. The Contractor shall provide the appropriate software version and licenses and configuration.
- l. Site name and authorization shall be established by User and Group. Permissions shall be assigned for all system functions.
- m. IP Camera Alarm Processing
- 1) The system shall be capable of monitoring alarm points and motion detection built in the cameras provided.

- 2) Camera inputs and monitoring point alarms shall be logged and annunciated by the system.
  - 3) The system shall be capable of using camera motion detection to trigger for the following features.
    - a) Change frame rate to any cameras for duration of event.
    - b) Mark recorded video as an alarm event.
    - c) Initiate video call up.
    - d) Trigger PTZ preset, auto panning, or tour.
    - e) Send alarms to all workstations.
    - f) Initiate audio plus video recording to a dedicated network storage device.
  - 4) The system shall be capable of editing and deleting any monitoring or motion detection point.
- n. Video Authentication
- 1) The system shall provide authentication marking for all archived video.
- o. The software shall employ a compression algorithm based on:
- 1) H.264 and/or H.265
  - 2) Selectable resolution (quality) not requiring a need to restart the application or the network video recorder.
- p. The software installed on both servers and workstations shall be similar in:
- 1) Graphical User Interface, therefore, an operator shall need to learn only one (1) interface for both control and programming of the system.
  - 2) Functions offering the ability to remotely configure most system components from any recorder or workstation.
- q. Auxiliary Inputs and Audio Monitoring capabilities
- 1) The software shall be capable of offering features including the simultaneous display, playback, distribution and archive of multiple channel video and audio. It shall collect multiple channels of video for the purpose of display, archive and requested distribution across the Ethernet network. Cameras, microphones and sensors shall be the primary input devices. Each channel of video and audio data shall have the capability of being displayed, played back, distributed and archived simultaneously across several servers and clients across the network. Each sensor channel shall support a NO or NC device. The software shall also have full WAN and Internet capability, offering expandability beyond a LAN.
- r. User Management

- 1) The system shall be configured to control user access and rights through individual User Ids and User Groups. Coordinate with the Owner to configure users, groups, and permissions.
- 2) The system shall require each user to log on to gain access to the system.
- 3) The login window shall consist of a User Name and Password field.
- 4) The system shall support an unlimited amount of User logon Ids and User Groups.
- 5) Access rights shall be granted to individual users or entire user groups.
- 6) The software shall allow for each group to be authorized or denied access, per component, to:
  - a) Log-in.
  - b) Log-out.
  - c) Set-Up.
    - (1) Network Setup & Site Name.
    - (2) User and Group Management.
    - (3) Auto Login.
    - (4) Macro – Create & Edit.
    - (5) Alarm Setup.
    - (6) Authentication Settings.
    - (7) Device Setup.
    - (8) Pre & Post Alarm.
    - (9) Storage Database Utilities.
    - (10) Auto Record.
    - (11) Exit to OS.
    - (12) Priority Setup.
    - (13) Registration Setup.
    - (14) Manual Record Setup.
    - (15) Reports.
    - (16) Scheduler/Macro.
    - (17) Shutdown/Close.
    - (18) Record.
    - (19) Stop.

- (20) Change Quality.
  - (21) Picture.
  - (22) Export.
  - (23) Print.
  - (24) Controls.
  - (25) Live View.
  - (26) Playback.
  - (27) PTZ.
  - d) Access to all programming menus.
  - s. System Scheduling
    - 1) The system shall be capable of automatically adjusting system settings via a scheduling interface.
    - 2) The scheduling interface shall control the following features:
      - a) Recording settings by individual camera and camera group.
      - b) Monitor Configuration.
      - c) Alarm notification.
      - d) Camera tours.
      - e) System backup.
      - f) User access.
      - g) Alarm notifications.
  - I. The VSS management, viewing, and recording system software shall be fully compatible with and officially support the cameras, recorders, viewing workstations, and all other components of the VSS.
  - J. The VSS management, viewing, and recording system shall be the latest version of Milestone XProtect, no equal. Provide the appropriate software version to provide all features required by this specifications section and provide all required licenses. All licenses shall be provided by the Contractor through the end of the warranty period at no additional cost to the Owner. All VSS components are required to match the Owner's existing VMS system and VSS standards in order to be fully compatible with the Owner's existing VSS, so no other equal manufacturers shall be considered.
- 2.11 VSS VIDEO MONITORING AND MANAGEMENT WORKSTATIONS
- A. Local Video Monitoring and Management Workstations
    - 1. Provide local video surveillance workstations as shown on the Contract Drawings.

2. The workstation shall, at minimum, meet each of the following requirements:
  - a. Desktop or floor mountable with all required accessories
  - b. Current generation Intel Core i7 desktop processor.
  - c. Minimum 16GB of RAM
  - d. Current generation discrete graphics card with minimum 2GB dedicated graphics memory. The graphics card shall be compatible with and supported by the VMS for hardware-accelerated camera stream video decoding.
  - e. 10/100/1000 Ethernet adapter
  - f. Operating System Drive: At minimum 1TB hard drive
  - g. Ports: at minimum three USB ports and two digital video output ports
  - h. Optical drive: Not required.
  - i. Operating System: Windows 10 Pro
  - j. Peripherals: optical USB computer mouse and wired USB computer keyboard
  - k. Power supply: power supply sized appropriately to support all components which are required
  - l. Provide VSS workstations in capacities and quantities as required to support the VSS systems as described by the Contract Documents.
3. Video Surveillance System local monitoring and management workstation shall be as manufactured by Milestone, BCDVideo, Dell, HP, Lenovo, or approved equal. Provide the appropriate software version to provide all features required by this specifications section and provide all required licenses. All licenses shall be provided by the Contractor through the end of the warranty period at no additional cost to the Owner. All VSS components are required to match the Owner's existing VMS system and VSS standards in order to be fully compatible with the Owner's existing VSS.

**B. Remote Video Monitoring**

1. Coordinate with the Owner for remote and mobile viewing capability of the local VSS from Owner-provided remote and mobile devices.
2. Provide equipment, connectivity, configuration, and integration of the local VSS to integrate with the Owner's existing VSS and enable the Owner's remote and mobile viewing.

**2.12 VIDEO SURVEILLANCE SYSTEM STORAGE SERVERS**

- A. Servers shall be state-of-the-art, server-grade computers. They shall be fully equipped with the VSS software.
- B. The storage server shall, at minimum, meet each of the following requirements:
  1. Rack mountable with all required accessories

2. Minimum current generation octa-core Intel Xeon Silver processor.
  3. Minimum 16GB of RAM or greater as recommended by the VMS manufacturer for the specific system capacity
  4. 10/100/1000 Ethernet adapter
  5. Operating System Drive: At minimum (two) 2 256GB solid state drives in RAID 1
  6. Video Storage: Support for RAID 5 and RAID 6. Provide RAID 6 configuration and the quantity of hard drives required to support RAID 6 while meeting the video storage requirements.
  7. Video Storage Drives: enterprise class hard drives in size and quantity as required to meet video storage requirements. Refer to item 2.10H.1.d “Video Storage Capacity” above for details and requirements.
  8. Throughput to disk: sufficient to meet recording requirements.
  9. Ports: at minimum three USB ports and one (1) digital video output ports
  10. Optical drive: Not required.
  11. Operating System: current generation Microsoft Windows Server Standard
  12. Peripherals: optical USB computer mouse and wired USB computer keyboard
  13. Power supply: dual power supplies sized appropriately to support all components which are required to meet storage and viewing requirements.
  14. Provide VSS software and storage server in capacities and quantities as required to support the VSS systems as described by the Contract Documents. Submit storage calculations to show that recording requirements shall be met by the recording system to be provided.
- C. Video Surveillance System Storage Server shall be as manufactured by Milestone, BCDVideo, Dell, HP, Lenovo, or approved equal. Provide the appropriate software version to provide all features required by this specifications section and provide all required licenses. All licenses shall be provided by the Contractor through the end of the warranty period at no additional cost to the Owner. All VSS components are required to match the Owner’s existing VMS system and VSS standards in order to be fully compatible with the Owner’s existing VSS.
- 2.13 SECURITY NETWORK ACCESS LAYER SWITCHES
- A. Security Network Access Layer Switches shall be provided by the Owner.
  - B. Coordinate with the Owner for all Security System requirements including but not limited to port counts, Power over Ethernet (PoE), bandwidth, virtual local area networks (VLANs), IP addresses, Quality of Service (QoS) (as required), network time protocol (NTP), and network security.
- 2.14 CATEGORY-6A CABLE
- A. Security Network Cabling shall be Category-6A rated, unshielded twisted pair (UTP) cabling.
  - B. Cable shall support minimum 1000 Mbps data communication.

- C. All Security Network Category-6A cables shall have a PURPLE colored jacket.
- D. Refer to Specifications section 271000 Structured Cabling System for additional details and requirements.

#### 2.15 CAMERA POWER SUPPLIES

- A. All new cameras shall be powered by the PoE network switches provided by the Owner except when specifically noted otherwise. Any cameras requiring additional supplementary power supplies shall be provided with appropriately rated power supplies and all required accessories.

#### 2.16 EQUIPMENT RACK

- A. Provide 19" equipment rack style enclosure to house all new video surveillance equipment in the Performing Arts Center IT Room.
- B. The equipment room racks shall be sized to contain all required equipment while fitting within the room and maintaining all code-required clearances and unobstructed access to other items in the room.
- C. Provide intake and exhaust fans with removable dust filters. The contractor shall ensure that sufficient airflow is provided from and to the conditioned area to maintain equipment environment temperature that is 80 degrees Fahrenheit or less.
- D. Provide all required accessories, mounting accessories, cable management, and all other required pieces to provide for an organized and workmanlike installation.
- E. Refer to Specifications section 271000 for additional details and requirements.

#### 2.17 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. Coordinate with the Division 26 Electrical Contractor to provide UPS-backed emergency power for all Security Systems equipment and devices.
- B. Refer to the Division 26 specifications and coordinate with the Division 26 Contractor.

#### 2.18 EXTERIOR CAMERA ETHERNET LIGHTNING PROTECTION

- A. Provide lightning protection for each cable run to exterior cameras.
- B. Refer to Specifications section 271000 for additional details and requirements.

### PART 3 - EXECUTION

#### 3.1 INSPECTION AND PREPARATION WORK

- A. This Contractor shall examine the conditions under which the system installation is to be performed, and notify the Owner's Representative or Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.

- B. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other work, which penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

### 3.2 INSTALLATION

- A. All equipment shall be installed per the requirements of the manufacturers.
- B. All equipment shall be utilized for the purpose for which it was designed and manufactured.
- C. All cameras shall be installed at the approximate locations shown on the Contract Drawings. Field adjustments shall be made as required to provide the field of view of the area to be monitored. Where any field adjustments are required, the Contractor shall notify the Design Professional prior to installation for review and approval.
- D. Electric power and power supplies shall be provided for all equipment as required and supplies shall have the performance characteristics compatible with the unique requirements of the equipment being supplied. Power supplies shall be loaded to a maximum of 60% of the rated power output.
- E. All surface mounted conduit and infrastructure shall be painted to match mounting surface as directed by the Owner.

### 3.3 SYSTEM SETUP

- A. The Contractor shall be responsible for the setup and programming of the video surveillance system.
- B. All video surveillance cameras viewing area and focus shall be as directed by the Owner and Design Professional.
- C. The recorder shall be completely programmed. All configurable fields shall be set as directed by the Owner.
- D. It shall be the responsibility of this contractor to test, confirm, adjust, retest, and reinstall any defective infrastructure equipment if it is determined during programming that infrastructure failures exist.

### 3.4 FIELD QUALITY CONTROL

- A. A project manager shall be appointed during the course of the installation. This shall assure complete coordination and technical information when requested by other trades. This person shall be responsible for all quality control during installation, equipment set-up and testing. This individual shall have training to provide firsthand knowledge of the installation.
- B. Verify, prior to installation of enclosures or mounting accessories, that field of view of each camera is not obstructed. If such conflicts occur, coordinate with the Design Professional, Owner, General Contractor, Construction Manager, and all affected trades prior to installation.

3.5 ADJUSTING AND TESTING

- A. Contractor shall be required to perform complete testing and verification of the following:
1. Complete, end-to-end cabling connectivity.
  2. Adjustment, verification, recalibration, and disassembly and reassembly of replaced or modified equipment furnished by the owner shall be the responsibility of this contractor until acceptance is obtained from the Owner and Design Professional.
  3. For each camera, verify video clarity, focus, aim, coverage, brightness, contrast, color, stream profiles, compression, recording, recording retention, and overall device health and optimization.

3.6 SUBSTANTIAL COMPLETION

- A. Prior to requesting the Design Professional to perform a substantial completion punch list inspection, the Contractor shall provide a complete report generated by the VMS and/or automatically pulled from the cameras themselves using the manufacturer's configuration tools to demonstrate that the server and all cameras are configured as required. These reports shall show, at minimum, the following information: camera name, camera IP address, stream profiles including resolution and frame rate, recording settings and schedule, bit rate settings, and image settings (WDR, DNR, etc).

3.7 COMPLETION OF WORK

- A. The Contractor shall be required to verify the following:
1. Pull ropes are provided and maintained in all conduits.
  2. All fastenings are properly secured.
  3. Clean all equipment of construction debris and dust and leave equipment in a "like-new" condition.

END OF SECTION 282300