

SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Basic electrical requirements, which are specifically applicable to all Division 28 Sections, in addition to the requirements of Division 1 - General Requirements.

1.2 SUBMITTALS

- A. Provide submittals in accordance with Section 01330 - Submittal Procedures.
- B. Submittal data containing manufacturer's data shall be sent to the Architect, Engineer and Owner for review.
- C. Electronic submittal data shall be assembled in Adobe Acrobat's Portable Data Format (PDF) for review.
- D. Electronic submittal data shall be assembled in one (1) complete PDF file and shall include an index sheet (TOC) listing each submittal item by specification number and its content. Each file shall also be organized with "Bookmarks" of each section. Submittals that do not have each submittal item referenced by "Bookmarks" shall be rejected.
- E. All electronic submittal data for a trade shall be submitted at one time except as noted herein.
- F. Data not submitted shall have a statement explaining why the data was not submitted.
- G. Submittals not conforming to any of the above requirements shall be rejected.
- H. The contractor shall go to each specification section to determine all technical information/data required and organize information/data using tabs for major headings as follows:
 - 1. Section 281300 – Security Access
 - a. Product Data
 - b. Shop Drawings
 - c. Equipment List
 - d. Field Quality Control Test Reports
 - e. Warranty
 - 2. Section 282300 - Video Surveillance
 - a. Product Data
 - b. Shop Drawings
 - c. Equipment List
 - d. Field Quality Control Test Reports
 - e. Warranty
 - 3. Section 283110 - Fire Alarm System
 - a. Product Data
 - b. Shop Drawings
 - c. Qualification Data
 - d. Field Quality Control Test Reports
 - e. Submittals to Authority having jurisdiction.
 - f. Documentation
- I. Manufacturer's data sheets shall be marked to clearly indicate the manufacturer, model number, size, color, accessories, required clearances, field connection details, weight loading, electrical characteristics, capacities, etc. being submitted. Variations from specifications shall be explained. Submittal preparer's name and telephone number shall be listed on the index sheet.
- J. Only manufacturers listed in specifications or addendums will be considered.

- K. Review, corrections, or comments made on the submittals do not relieve the Contractor from compliance with the requirements of the Drawings, Specifications and Addendums (Contract Documents). By entering into this Contract, the Contractor agrees that the purpose of submittals is to demonstrate to the Engineer that the Contractor understands the design concept and that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and use. Review of shop drawing will be general only for basic conformance with the design concept. The review of such drawings, schedules or cuts shall not relieve the Contractor from the responsibility for correcting all errors of any sort contained in the submittals. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting proper fabrication processes, construction methods and installation techniques; coordinating this work with that of all other trades; and performing all work in a safe, workmanlike and satisfactory manner.
- L. Below are the submittal item codes that will be used when reviewing the submittal data. These codes show up on the "Submittal Review" sheet. Only one copy of the submittal review sheet is returned upon completion of the submittal review.
1. RNE - Reviewed, No Exceptions Noted
 - a. Indicates the information provided has been reviewed and no exceptions are taken. Contractor must still comply with the contract documents.
 - b. No corrective action required at this time.
 2. FNC - Furnish with Noted Corrections
 - a. Indicates the contractor shall insure that all necessary or noted corrections are incorporated into equipment furnished to the project.
 - b. Contractor shall incorporate items requested in review comments, but re-submittal not required.
 3. RES - Revise and Resubmit
 - a. Indicates item is not presently acceptable as submitted, but may be accepted provided additional information and/or changes are made.
 - b. Contractor shall revise and resubmit item to Engineer with additional information indicating compliance with Contract Documents prior to proceeding with work.
 4. PSD - Provide Submittal Data
 - a. Indicates submittal data was not provided for this item or section.
 - b. Contractor shall provide submittal data meeting the explicit requirements of the plans, specifications, and all addenda.
- M. Shop drawings and data submittals for materials requiring extra long delivery time shall be submitted for approval as soon as possible after execution of contract. All sleeves must be precast in concrete or concrete block and accordingly provided to the mason in a timely manner. Accordingly, all items such as these shall be submitted for approval in a timely manner (prior to other submittals if necessary) so they may be properly incorporated in the building's structure. Allow a minimum of three weeks for review. No substitutions of materials or extensions of contract time will be allowed for Contractor's failure to submit or order such materials sufficiently in advance of the work. See Architectural specification section for additional requirements for submittals.

1.3 REGULATORY REQUIREMENTS

- A. All work installed under Division 28 shall conform to the current adopted Edition of Building/Electrical Codes and their appropriate amendments:
1. NFPA 70 2023 National Electrical Code
 2. Life Safety Code, NFPA 101
 3. Requirements of the State of Georgia Fire Marshall's Office.
 4. GA State Energy Code.
 5. Standard Building Code
 6. Standard Mechanical Code (Georgia Edition)
 7. Standard for Health Care Facilities, NFPA 99

8. National Fire Alarm Code NFPA 72
 9. Standard for Emergency and Standby Power Systems NFPA110
 10. Standard for Lightning Protection System NFPA 780
 11. City of McDonough and Henry County Codes
- B. Obtain and pay for all permits, and request inspections from all authorities having jurisdiction, in a timely manner.
- C. Materials and Equipment included in Underwriter's Label Service shall bear that label. Electrical equipment shall be UL approved as installed, and bear the UL label, unless noted otherwise herein.
- D. Where requirements of these specifications differ from specified codes and ordinances, conform to the more stringent requirements.

1.4 CONTRACTOR GUARANTEE

- A. All equipment and materials furnished and all work performed under these specifications, shall be guaranteed to be free of defective materials and workmanship for a period of one year (unless a longer period is specified elsewhere) after Architect's Final Certificate. Upon notice of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be promptly replaced with new parts by the Contractor at no additional cost to the Owner. All labor required to perform guarantee shall be included as part of the complete guarantee warranty.

1.5 OPERATING AND MAINTENANCE (O&M) MANUALS

- A. Three bound and indexed Operating and Maintenance Manuals shall be prepared by the Contractor and be submitted for approval prior to delivery to operating personnel. Binders shall be 3-ring commercial grade, complete with inside storage pockets, sheet protectors, spine and front cover labels.
- B. Operating and maintenance manuals shall also comply with Division 1 Section "Operation and Maintenance Data."

1.6 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on Drawings, unless prevented by project conditions. Shift or relocate equipment or systems to avoid conflicts with other trades. Modifications to the work required to accommodate project conditions encountered in the field shall be made at no additional cost to the contract.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.
- C. Install items so that there are no obstructions (e.g., pipes, conduits, etc.) blocking service panels of the equipment, or preventing the removal of the equipment.
- D. Electrical items are shown on drawings in approximate locations unless dimensioned. Install at location required to serve intended purpose. Include installation within ten (10) feet of location shown.

1.7 SEQUENCING AND SCHEDULING

- A. Contractor shall coordinate work so as to avoid conflicts with other work in progress.
- B. Work shall progress in a manner that will not interfere with other trades. The Division 28 Contractor shall have coordination meetings with all other Contractors to ensure that all systems installed in "share areas" (e.g. ceiling plenums, mechanical rooms, etc.) are coordinated and installed to insure proper fit and access. All costs required for the coordination of the work between trades shall be borne solely by the Contractor.

- C. Contractor shall provide confirmation letters from the factory (not from the contractor) to the Owner that long lead items have been ordered. Long lead items are defined as items having longer than six-week fabrication schedules. See other sections for additional requirements.

1.8 ACCEPTABLE PRODUCTS

- A. Where a manufacturer has been listed as being acceptable in the various specification sections hereinafter for a certain product, it shall be understood that the manufacturer has been approved as being capable of producing this product. This does not necessarily constitute approval of his standard product. His product shall still comply with all of the requirements and standards of this specification and not necessarily his standard specification, to the extent that it might require special manufacture to meet the requirement and standards of this specification.
- B. Prior Approval: Substitutions of specified items and prior approvals of other manufacturers will not be considered.
- C. Addenda: If the substitution is allowed, such approval will be set forth in an Addendum.
- D. Costs: All costs incurred by the acceptance of substitutions shall be borne by the contractor.

1.9 DRAWINGS

- A. General: Both the drawings and specifications shall be considered supplemental to one another so that materials and labor required by one but not the other shall be supplied and installed as though specifically called for by both. Where drawings and specification conflict, Contractor shall conform to the more stringent or costly of the two requirements.
- B. Scaling: The drawings are diagrammatic only and show generally the location of the equipment, ducts and pipes but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication of work from the drawings shall be at the Contractor's risk.
- C. Existing Conditions: It shall be the Contractor's responsibility to visit the site prior to bidding the project and prior to beginning work to make himself familiar with existing conditions.

1.10 PROTECTION OF MATERIALS AND EQUIPMENT

- A. Delivery, Storage and Handling: Deliver products to site in factory-fabricated protective containers, with (where appropriate) factory-installed shipping skids and lifting lugs. Store in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- B. Prior to Final Construction Review: All materials and equipment shall be cleaned. Chipped or scraped paint shall be retouched to match.
- C. Equipment Painting: Equipment which has been damaged beyond the point of retouching or has been retouched not to match the original finish shall be repainted in accordance with the Architectural painting section.

1.11 CLEANING

- A. The Contractor shall maintain the site reasonably clean and free of excessive debris and leftover materials at all times. All trash and debris shall be hauled from the job site on a daily basis for disposal. Prior to testing and adjusting, equipment shall be clean and free of any construction debris and litter.
- B. Contractor shall meet all contractual requirements as related to site cleanliness including dust control.

1.12 ROOM NUMBERS

- A. The room numbers indicated on the Contract Documents were provided by the Architect to assist in identifying spaces during construction. These room numbers may not necessarily be the Owner's final choice of room numbers. The contractor shall obtain from the Owner the final choice of room numbers, and shall use these numbers wherever required. (For example, room numbers are used in programming of fire alarm systems and intercom system, and shall match the Owner's final choice.)

END OF SECTION 280500

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SECTION 281300 - SECURITY ACCESS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes a security access system consisting of a Central Network Station, one networked workstation computer, operating system and application software, and field-installed Controllers connected by a high-speed electronic data transmission network. The security access system shall have the following:
 - 1. Access Control:
 - a. Regulating access through doors.
 - b. Visitor assignment.
 - c. Time and attendance.
 - d. Surge and tamper protection.
 - e. Secondary alarm annunciator.
 - f. Credential cards and readers.
 - g. Push-button switches.
 - h. Credential creation and credential holder database and management.
 - i. Monitoring of field-installed devices.
 - j. Reporting.
 - 2. Security:
 - a. Video and camera control.
 - b. Interface with Video Surveillance system.

1.2 DEFINITIONS

- A. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
- B. CCTV: Closed-circuit television.
- C. Central Monitoring Station: A PC with software designated as the main controlling PC of the security access system and Video Surveillance system. Where this term is presented with initial capital letters, this definition applies.
- D. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
- E. CPU: Central processing unit.
- F. Credential: Data assigned to an entity and used to identify that entity.
- G. dpi: Dots per inch.
- H. File Server: A PC in a network that stores the programs and data files shared by users.
- I. GFI: Ground fault interrupter.
- J. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- K. I/O: Input/Output.
- L. LAN: Local area network.
- M. LED: Light-emitting diode.
- N. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.
- O. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

- P. RF: Radio frequency.
- Q. ROM: Read-only memory. ROM data are maintained through losses of power.
- R. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- S. TWAIN: (Technology without an Interesting Name.) A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.
- T. UPS: Uninterruptible power supply.
- U. WAN: Wide area network.
- V. WAV: The digital audio format used in Microsoft Windows.
- W. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
- X. Windows: Operating system by Microsoft Corporation.
- Y. Workstation: A PC with software that is configured for specific limited security system functions.
- Z. WYSIWYG: (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.

1.3 SYSTEM DESCRIPTION

- A. The S2 NetBox™ / Enterprise Security Management System shall be implemented through network appliance architecture with a three-tiered modular hardware hierarchy and embedded three-tier software architecture.
 - 1. The network appliance shall be capable of running on an TCP/IP network and shall be accessible, configurable, and manageable from any network-connected PC with a browser.
 - 2. Browser access for configuration and administration of the system shall be possible from a PC on the same subnet, through routers and gateways from other subnets, and from the Internet. Control and management of the system shall therefore be geographically independent.
 - 3. Security of the data communicated over the network to and from the browser, Network Controller, and nodes shall be protected by encryption (SSL 128-bit) and authentication (SHA-1).
 - 4. The top hardware tier shall be the Network Controller. Embedded on the Network Controller shall be an operating system, a web server, security application software, and the database of personnel and system activity.
 - 5. The middle hardware tier shall be the Network Node. The Network Node shall make and manage access control decisions with data provided by the Network Controller, and it shall manage the communication between the Network Controller and Application blades connected to the system's inputs, outputs, and readers. This modular design shall make it possible, even during network downtime, for the system to continue to manage access control and store system activity logs. When network connectivity is re-established, the system activity logs shall be automatically re-integrated.
 - 6. The bottom hardware tier is the Application Blades. Four unique Application blades shall be available:
 - a. Access Control Blade: shall support two readers, four supervised inputs, and four relay outputs.
 - b. Alarm Input Blade: shall support eight supervised inputs.
 - c. Relay Output Blade: shall support eight relay outputs.
 - d. Temperature Blade: shall support eight analog temperature sensor inputs.

- B. The S2 system shall integrate, within a browser interface, access control, alarm monitoring, video monitoring, and temperature monitoring applications. These applications shall be embedded in a three-tier software architecture.
 - 1. The database tier shall use PostgreSQL. This shall provide a small footprint, low administration, and high reliability relational database that is embedded without requiring the use of a separate PC server.
 - 2. The web server tier shall be based on an Apache™ embedded web server. This shall provide a graphically rich security management application through a standard web browser.
 - 3. The web browser shall provide UL 1076 compliant browser-based monitoring and incorporate asynchronous Javascript™ and XML technology (AJAX) for a faster user experience.
 - 4. The security application software tier shall contain the business logic. This application shall also be embedded on the network device and requires no additional memory or processing power.
 - 5. This three-tiered embedded software design shall run within an embedded Linux operating system and shall require no client-side software other than a web browser.
- C. All equipment and materials used shall be standard components, regularly manufactured, and regularly utilized in the manufacturer's system.
- D. All S2 systems and components shall have been thoroughly tested and proven in actual use.

1.4 OVERALL SYSTEM CAPABILITY

- A. The S2 Security Management System shall meet the requirements of educational facility access control systems. The system shall monitor and control facility access, and shall perform alarm monitoring, camera and video monitoring, communications loss monitoring, and temperature monitoring. The system shall also maintain a database of system activity, personnel access control information, and system user passwords and user role permissions. The system shall be controlled from a web browser and require no software installation or client licenses. The system shall provide control and access to users on Local Area Networks (LAN), Wide Area Networks (WAN), wireless networks, and the Internet. The system shall provide email and/or text message alerts for all alarm conditions and threats.
- B. Widget Desktop: The S2 system shall provide a widget-based user interface that enables users to create custom monitoring layouts by selecting and arranging widgets on a desktop. Each widget shall provide easy access to a frequently used function—allowing users to, for example, view an activity log, a camera view, or real-time web content. System administrators can save custom layouts for subsequent call up by users, who can then arrange the widgets as desired on their desktops. The administrator shall determine which widgets are available in a layout and the extent to which users can customize the layout.
- C. The S2 system shall provide the following Access Control capabilities:
 - 1. Integrated photo ID creation capability with video verification.
 - 2. User interface secured access under encrypted password control.
 - 3. Region occupancy counting and control.
 - 4. "First-in-unlock" rule enforcement.
 - 5. Multiple access levels and cards per person.
 - 6. 128-bit card support for Weigand card readers.
 - 7. Detailed time specifications.
 - 8. Simultaneous support for multiple card data formats.
 - 9. Elevator control.
 - 10. Access privileges variable by threat level.
 - 11. Scheduled portal unlock by time and threat level.
 - 12. Card format decoder quickly discovers unknown card formats.
 - 13. Card enrollment by reader or keyboard.

14. Compatibility with various input devices, including biometric readers.
 15. Activation/expiration date/time by person with one minute resolution.
 16. Access level disable for immediate lockdown.
 17. Use of Threat Levels to alter security system behavior globally.
 18. Multiple holiday schedules.
 19. Timed unlock schedules.
 20. Scheduled actions for arming inputs, activating outputs, and locking and unlocking portals.
 21. Card enrollment reader support.
 22. Counted-use access control.
 23. Dual-reader portal support.
 24. Wiegand Reader support.
 25. Magnetic-stripe reader support with cards using ABA Track 2 format for up to 200 bits.
 26. Wiegand keypad PIN support for 4-digit or 6-digit PINs.
 27. 8-bit and 4-bit burst keypad support for 4-digit or 6-digit PINs.
 28. Integration with supported alarm panels.
 29. Optional storage and recall of ID photos and personal/emergency data.
 30. Up to 60,000 person records.
- D. The S2 system shall provide the following Monitoring capabilities:
1. Common alarm panel integration for disarm on access, and arm on egress.
 2. Integrated alarm monitoring and event management with alarm panels.
 3. Support for the direct viewing of IP cameras.
 4. Integrated real-time IP, and NVR systems with stored video replay for events.
 5. Provides alarms on video loss, video motion detection, and video restore events.
 6. Virtual inputs for video loss and building-occupancy-limits-exceeded.
 7. Provides alarms on communication loss and temperature variation.
 8. Support for the creation of custom sets of alarm event actions.
 9. Provides the ability to record video and link to video for alarm events.
 10. Available video control and playback through the S2 System user interface.
 11. Provides the ability to assign threat levels to various alarms according to severity.
 12. Provides the ability to select up to 20 levels of priority for event actions.
 13. Support for electronic supervision of alarm inputs.
 14. Support for the use of output relays for enabling circuits under alarm event control.
 15. A monitoring desktop that integrates video, system activity logs, floor plans, ID photos, and alarm notifications.
 16. Support for the creation of unlimited customized monitoring layouts through the use of widgets.
 17. Graphic floor plans with active icons of security system resources.
 18. System user permissions to grant whole or partial access to system resources, commands, and personal data.
 19. Secure access to the user interface under encrypted password control
 20. Delivery of alerts via browsers, email, and text messages.
- E. The S2 system shall provide the following Video Management capabilities:
1. Real-time video monitoring displays, including unlimited cameras simultaneously.
 2. Playback of event-related video.
 3. Video switching and video widget pop-ups based on access activity or event activation.
 4. Integrated alarm inputs from the video management system.
 5. Digital playback of video events.
 6. Linking of video and events based on triggers provided by the S2 system or video system.
 7. Support for multiple NVR systems.
 8. Multiple pre-programmed supported cameras.
 9. Recall of photo ID and real-time image for comparison.

10. Monitoring and control through a web browser interface.
 11. System user permissions to grant whole or partial access to system cameras and video resources.
- F. The S2 system shall provide the following Security Database capabilities:
1. Maintain data of system activity, personnel access control information, system user passwords and custom user role permissions for whole or partial access to system resources and data.
 2. Built-in Open Database Connectivity (ODBC) compliant database for personal data.
 3. LDAP integration for single-user logon authentication.
 4. Up to 60,000 person records.
 5. Network-secure API for external application integration.
 6. Extensive and easy to use custom report generator.
 7. User-defined data fields in personnel records.
 8. Record recall by vehicle tag, name, or card.
 9. ODBC compliant Database.
 10. An API for adding to, deleting from, and modifying the database.
 11. Storage of system user passwords and permissions.
 12. Storage and recall of ID photos and emergency personal information.
 13. Pre-defined reports on system configuration, system activity history, and people.
 14. English-based query language for instant custom reports.
 15. Custom report writer interface that allows the interactive creation of custom reports. Reports may be saved for later reuse. No third-party software (such as Crystal Reports) shall be necessary.
 16. Periodic backup to on-board flash ROM and optional network attached storage (NAS), including FTP servers.
 17. Periodic archive creation for historical custom reporting and improved on-board database performance.
 18. Email and text messaging (SMS) alert notifications.

1.5 HARDWARE REQUIREMENTS

- A. The S2 Security Management System shall employ a modular hardware concept that enables simple system expansion and utilizes a three-tiered hardware hierarchy:
1. At the top tier is the Network Controller, which shall contain the database engine, web server, application software, and configuration data. It is at this level that System Users, through a browser interface, shall interact with the S2 system, set configurations, monitor activities, run reports, and manage alarms.
 2. At the second tier is the Network Node, an intelligent device with native TCP/IP support, which shall make and manage access control decisions.
 3. At the third tier are the application extension blades. Each of these blades shall connect to and manage a set of inputs, outputs, readers, cameras, or temperature monitoring points.
 4. The network device shall run on building's TCP/IP networks and shall be configurable for access from separate subnets, through gateways and routers, and from the Internet. A MicroNode shall also be available that combines an Access Control blade and Network Node.
- B. The Network Node shall contain the operating system, database engine, web server, application software, and configuration data.

- C. A solid-state Network Node shall consist of a blade-style, circuit card that also combines a Network Node on the card. The Network Controller portion of the card shall contain a processor, flash memory, and a network switch. The Network Node shall be supplied with 12V DC at a minimum of 3 amps. Internal battery backup shall supply sufficient power to provide for an orderly shutdown of the system in case of loss of external power. External battery backup shall be used to provide uninterrupted operation in the event of external power loss. The Network Node portion shall contain a serial port for communication with the Application blades and a network interface port.
- D. The S2 NetBox™ Extreme Network Controller shall be rack-mount enclosure. It shall contain a motherboard with an Intel® Atom™ processor and solid-state disk drive. An Ethernet connector shall be provided for network connection.
- E. The S2 Enterprise Ultra Network Controller shall consist of a rack-mounted controller with additional processing power and memory, RAID-1 disk drive array, serial port and network connections.
- F. The Network Node shall make and manage access control decisions with data provided by the Network Controller, and it shall manage the communication between the Network Controller and Application blades connected to the system's inputs, outputs, and readers. The Node shall be supplied with 12V DC at a minimum of 3 amps. The Node blade shall supply all Application blades in the node with power. The Network Node shall be available in three configurations: a combined Network Controller/Network Node blade; a standalone Network Node blade, and a MicroNode with included Access Control blade. Each Network Node shall support up to seven Application blades except for the MicroNodes. Communications between the node and Network Controller shall be encrypted and authenticated (SHA-1).
- G. The Application blades shall interface with the Network Node. The Application blades shall be blade-style circuit cards. There shall be four types of Application blades:
 - 1. Access Control blade: shall support 2 readers (input devices such as keypads, RFID devices or Biometric readers), 4 supervised inputs and 4 relay outputs.
 - 2. Supervised Input blade: shall support 8 supervised inputs. Supervised input connectors are 2-pin. The system shall support a wide variety of input supervision types including normally-open circuit and normally-closed circuits, and zero, one or two resistor configurations.
 - 3. Relay Output blade: shall support 8 relay outputs. Relay output connectors are 3-pin. Both normally-open circuit and normally-closed circuit output devices are supported. The relay outputs shall support any output devices that operate on the following maximum electrical ratings: 30 Volts DC or AC, 2.5 Amps inductive or 5.0 Amps non-inductive.
 - 4. Temperature blade: shall support 8 analog temperature sensor inputs. Temperature range shall be 32° to 158° F (0° to 70° C). Temperature precision within that range shall be ±1.0° F (±0.5° C).
- H. The MicroNode shall combine a Network Node and an Application blade capability in one enclosure. The Access Control blade portion of the MicroNode shall support two readers, one temperature input, four supervised inputs and four relay outputs. A MicroNode shall utilize Power over Ethernet (PoE) at the 802.3AF standard and be capable of supplying direct power to 2 readers, 2 motion REXs, and 2 door strikes.

1.6 HARDWARE PACKAGING REQUIREMENTS

- A. The S2 NetBox™ /Enterprise Security Management System shall have various hardware enclosures and configurations available to support different installation requirements.
- B. The S2 4U Rack-Mount enclosure shall support one standalone Network Node blade and seven Application blades.

- C. The S2 MicroNode enclosure shall support a solid-state Node, its Access Control blade, and one temperature point.
 - 1. It shall be a wall-mount enclosure with dimensions of 7" (178 mm) H x 7" (178 mm) W x 3.5" (89 mm) D.
 - 2. It shall be possible to power the MicroNode with a PoE that conforms to the IEEE 802.3af standard. This provides nominal 48VDC at a maximum of 400mA.
 - 3. Provide power supply rated for 120V AC at 60Hz input with each MicroNode.
- D. The solid-state Network Node shall be powered by 100-240V AC at 50-60 Hz. Power must come from a separate circuit with an isolated earth ground. Provide backup power supply to the S2 system with an Uninterruptible Power Supply (UPS).

1.7 VIDEO MANAGEMENT INTEGRATION

- A. General: The S2 NetBox™ Security Management System shall support the integration of Digital Video Recorders (DVR) supporting analog video cameras and Network Video Recorders (NVR). This integration shall allow the viewing of live streaming video in the browser interface and recorded video playback. Viewing live streaming video shall require the Java™ 2 Runtime Environment version 1.4.2 or version 5.0.
 - 1. Events in the alarm subsystem can initiate video recording. Video motion detection, camera up and camera down messages from the VMS can initiate alarms.
 - 2. It shall be possible to monitor NVR cameras in the same views as IP cameras. VMS events shall be logged in the system activity log. It shall be possible to view recorded video of events from the Activity Log.

1.8 API INTEGRATION

- A. An application programming interface (API) is provided for the S2 NetBox™ Security Management system. The API provides programmatic access to the network-connected components managed by the S2 system.
 - 1. Communication between the S2 system and another application takes place through the TCP/IP networking protocol. The API is invoked by POSTing an HTTP message to the web server on the S2 Network Controller.
 - 2. The S2 database includes a table of "people" whose records act as container objects for attributes attached to people in real life. People are mapped to access levels, which specify access privileges—and to access cards, whose credentials are used for access control.
 - 3. Access levels are entered into the system using the normal web user interface for the S2 system. People and credentials may be entered into the system either through the web user interface or through the API.
 - 4. The API supports commands for:
 - a. Adding, modifying, removing, and retrieving data about a person, and retrieving information about one or more people based on various search criteria.
 - b. Adding, modifying, and removing credentials, and retrieving a list of the names of defined card formats.
 - c. Adding, modifying, and deleting access levels, and retrieving a list of the valid access levels in the system.
 - d. Pinging the S2 system to determine its health, and retrieving the current version of the API from the server.
 - e. Retrieving a history of access activity, either for all users or for a particular access card.
 - f. Adding, modifying, and removing threat levels and threat level groups, and setting the threat level in the system.
 - g. Retrieving a list of portals and associated card readers defined for the S2 system.
 - h. Adding, modifying, deleting, and retrieving time specifications and time specification groups.

- i. Adding, modifying, and deleting holidays, and returning a list of holiday keys or a specific holiday.
- j. Adding, modifying, deleting readers and reader groups, and returning a list of reader group keys or information for a specific reader group.
- k. Adding, modifying, and deleting portals and portal groups, and retrieving information about a specific portal group.

1.9 COORDINATION

- A. Door Hardware Interface: Coordinate with Division 8 Sections that specify door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 8 Sections to function with the controls, software and hardware in this Section.

1.10 SUBMITTALS

- A. Product Data: For each type of product indicated. Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings.
- B. Shop Drawings:
 - 1. Wiring Diagrams. Show typical wiring schematics including the following:
 - a. Workstation outlets, jacks, and jack assemblies.
 - b. Patch cords.
 - c. Patch panels.
 - 2. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
 - 3. Battery and charger calculations for Central Station, workstations, and Controllers.
- C. Project planning documents as specified in Part 3.
- D. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals.
 - 1. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 - 2. System installation and setup guides, with data forms to plan and record options and setup decisions.

1.11 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall be S2 Access Control certified as a company, no exceptions.
- B. Acceptable Prequalified Installers:
 - 1. AdaptToSolve Inc., LaGrange, GA.
 - 2. NetPlanner Systems, Atlanta, GA.
 - 3. Wachter, Inc., Suwanee, GA.
 - 4. Place Service Inc., Canton, GA.
- C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70, "National Electrical Code."
- F. Comply with SIA DC-03.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Controllers:
 - 1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, noncondensing.
 - 2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
 - 3. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
 - 4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.13 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Access Control Blades: Quantity one (1).
 - 2. Relay Output Blades: Quantity one (1).
 - 3. Card Readers: Quantity three (3).
 - 4. Door Status Monitoring Contacts: Quantity three (3).
 - 5. Request-to-Exit Devices: Quantity three (3).
 - 6. S2 Netdoor MicroNode in enclosure: Quantity three (3).
 - 7. Push-Button Switches: Quantity three (3).

1.14 PROJECT CONDITIONS

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
 - 2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. NEMA 250, Type 1 enclosure.
 - 3. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambient conditions of dry bulb and 20 to 90 percent relative humidity, noncondensing. NEMA 250, Type 3R enclosures.
 - 4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph. NEMA 250, Type 3R enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 SECURITY ACCESS SYSTEM

- A. Manufacturer: S2 Security.

2.3 SURGE AND TAMPER PROTECTION

- A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

2.4 ACCESS CONTROL SYSTEM (ACS) HARDWARE

- A. S2 Enterprise Ultra Network Controller: Provide rack mountable Enterprise Ultra Network Controller with Intel® Core 2 Quad 3.2 GHz processor, solid state drive in RAID-1 configuration minimum. The controller shall be mounted in a 19" equipment rack in the school system's data center.
- B. S2 NetBox Network Nodes: Provide rack mountable Network Nodes, S2-NN-E14R-RM, with 64 GB SSD storage option. The quantity of Network Nodes shall be determined by the number of card readers shown on the drawings plus three card reader spare capacity for each building. The Network Nodes shall be mounted in a 19" equipment rack.
 - 1. Provide wall mountable Network Nodes, S2-NN-E14R-WM, with 64 GB SSD storage option for intermediate Network nodes located in remote areas of the building in data closets.
- C. UPS: Self-contained static Uninterruptible Power Supply (UPS).
 - 1. Provide rack mountable Lithium-ion Smart UPS, APC # SMTL2200RM2UCNC.
 - 2. Size: Provide a minimum of 1 hour of operation of the controller equipment.
 - 3. Batteries: Sealed, Lithium-ion.
 - 4. Accessories:
 - a. Transient voltage suppression.
 - b. Input-harmonics reduction.
 - c. Rectifier/charger.
 - d. Battery disconnect device.
 - e. Static bypass transfer switch.
 - f. Internal maintenance bypass/isolation switch.
 - g. External maintenance bypass/isolation switch.
 - h. Output isolation transformer.
 - i. Remote UPS monitoring.
 - j. Battery monitoring.
 - k. Remote battery monitoring.
 - l. Network card.

2.5 SECURITY SYSTEM AND VIDEO SURVEILLANCE MONITORING STATION

- A. Workstation shall consist of a standard unmodified PC, with accessories and peripherals that configure the workstation for a specific duty.
- B. Workstation Computer: Standard unmodified PC by DELL of modular design, OptiPlex 7090 Minitower or equal. The CPU shall be at least 10th Generation Intel® Core i7.
 - 1. Memory: 16 GB of usable installed memory.
 - 2. Power Supply: Minimum capacity of 250 W.
 - 3. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.
 - 4. Color Monitor: Not less than 17 inches LCD UHD monitor.
 - 5. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.
 - 6. Mouse: Standard, cordless, compatible with the installed software.
 - 7. Disk storage shall include the following, each with appropriate controller:
 - a. Minimum PCIe NVMe Class 35 Solid State Drive.

2.6 MICRONODE

- A. Provide S2 Netdoor MicroNode in enclosure. The MicroNode shall operate with a power supply.

2.7 CARD READERS

- A. Power: Card reader shall be powered from its associated Controller, including its standby power source.
- B. Enclosure: Suitable for recessed, semi flush mounting as shown on the drawings. Mounting types shall additionally be suitable for installation in the following locations:
1. Indoors, controlled environment.
 2. Indoors, uncontrolled environment.
 3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.
- C. Read Only Contactless Smart Card reader:
1. Contactless smart card reader shall securely read access control data from 13.56 MHz contactless smart cards. The contactless smart card reader shall be optimally designed for use in access control applications by providing:
 - a. Secure access control data exchange between the smart card and the reader utilizing key diversification and mutual authentication routines.
 - b. Universal compatibility with most access control systems.
 - c. Guaranteed compatibility to read all HID data formats ensuring card-to-reader interoperability in multi-location installations and multi-card/reader populations when used with Genuine HID products.
 - d. Ease of installation through identical wiring methods as legacy 125 KHz proximity readers.
 - e. The ability to read expanded data format lengths up to 144 bits.
 - f. Backwards compatibility with legacy 125 KHz proximity access control formats (e.g., 26-bit, 32, 35-bit, 37-bit, 56-bit, and HID Corporate 1000 formats).
 - g. Optimal read range and read speed for increased access control throughput.
 - h. A full product line of compatible products including readers, readers with integral keypads and LCD displays, long range readers, biometric readers, read/write readers, card programmers, and cards.
 - i. Global, off-the-shelf availability.
 - j. Built in compatibility across the product line without the need of special programming.
 - k. Product construction suitable for both indoor and outdoor applications.
 - l. Customizable behavior for indicator lights and audible tones.
 2. Contactless smart card reader shall be configurable to read data simultaneously from the following card:
 - a. HID iCLASS Access Control Sector/Application data.
 3. Contactless smart card reader shall be HID Global iCLASS Model R40, base P/N 6120 (Wiegand)

2.8 ACCESS CARDS

- A. Manufacturer: HID, an Assa Abloy Group
- B. Access Cards:
1. Access cards shall store uniquely coded data used by card readers as an Identifier.
 - a. Wiegand Wire Effect Cards: Ferromagnetic wires laminated into the credential card using binary digits specified for Wiegand readers to generate a unique credential card identification code.
 - b. Proximity Cards: Use proximity detection without physical contact with the proximity reader for proper operation.
 2. Access cards shall be HID 2100 iClass/Prox Embeddable 13.56 MHz read/write contactless smart technology cards.

3. Quantity: Provide two hundred (200) cards per building with clear vertical format card holders and navy-blue break-away lanyards.
 - a. The cards and card holders shall be configured for vertical format badge.

2.9 REQUEST TO EXIT DETECTORS

- A. Manufacturer: Bosch.
- B. Request-to-Exit Detector:
 1. Provide universal mounting high performance door monitor with sounder alert and sequential Logic Input (SLI).
 2. The detector shall have wraparound coverage pattern with precise pattern control and up to 64 second adjustable latch time.
- C. Request-to-Exit detector shall be Bosch DS160 Series High Performance in Gray color and with matching trim plate.

2.10 DOOR STATUS MONITOR

- A. Manufacturer: Bosch.
- B. Door status monitors shall be 19mm terminal connection contacts.
- C. Provide Bosch ISN-CTC75-B terminal connection contacts in door matching color.

2.11 MASTER INTERCOM STATION

- A. Manufacturer: Aiphone.
- B. Master intercom station shall be provided for communication between the main entrance door and the general office area. The station shall be desk mountable.
- C. Provide Aiphone JP-4MED Master station with wide and zoom & pan/tilt color monitor & built-in picture memory. Include MCW-S/A desk stand and power supply.
- D. Provide master intercom stations for general office area.

2.12 DOOR INTERCOM STATION

- A. Manufacturer: Aiphone.
- B. Door intercom station shall be provided for communication between the main entrance door and the general office area master intercom station. The station shall be recessed mountable in wall in a single gang box.
- C. Provide Aiphone JP-DVF Flush mount door station weather and vandal resistant stainless steel door station with mechanical call button.

2.13 PUSH-BUTTON SWITCHES

- A. Manufacturers: Securitron Magnalock Corporation; an ASSA ABLOY Group Company.
- B. Push-Button Switches: Momentary-contact back-lighted push buttons, with stainless-steel switch enclosures.
 1. Electrical Ratings:
 - a. Minimum continuous current rating of 10 A at 120 V ac.
 - b. Contacts that will make 720 VA at 60 A and that will break at 720 VA at 10 A.
 2. Enclosures: Flush or surface mounting. Push buttons shall be suitable for flush mounting in the switch enclosures.
 3. Enclosures shall additionally be suitable for installation in the following locations:
 - a. Indoors, controlled environment.
 - b. Indoors, uncontrolled environment.
 - c. Outdoors.
- C. Power: Push-button switches shall be powered from their associated Controller, using dc control.

2.14 DOOR HARDWARE INTERFACE

- A. Exit Device with Alarm: Operation of the exit device shall generate an alarm. Exit device and alarm contacts are specified in Division 8 Section "Door Hardware."
- B. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Division 8 Section "Door Hardware."
- C. Electric Door Strikes: Use end-of-line resistors to provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electric strikes and electrified door hardware are specified in Division 8 "Door Hardware."
- D. Door Ajar Alarm: Monitored door left ajar for longer than two (2) minutes shall generate an audible and graphic alarm at the main monitoring station in the front office. Program all S2 access control systems to have this functionality.

2.15 CABLES

- A. Manufacturers:
 - 1. Anixter, Inc.
 - 2. Belden Inc.; Electronics Division.
 - 3. West Penn Wire/CDT; a division of Cable Design Technologies.
- B. Multiconductor access control banana peel composite cable. The composite cable shall consist of the following conductors in plenum rated jacket:
 - 1. Card Reader – 6 conductor 22 AWG BC overall shield with drain wire.
 - 2. Door Contact - 4 conductor 22 AWG BC unshielded.
 - 3. Request-to-Exit - 4 conductor 22 AWG BC unshielded.
 - 4. Electric Door Strike (Lock/Power) - 4 conductor 18 AWG BC unshielded.
- C. Provide Belden 658GMS Composite access control cable.
- D. Intercom Cable: 22 AWG two (2) wires, non-twisted and non-polarized, shielded, plenum rated.
 - 1. Provide larger gauge cable for long distance cable run. The cable shall be sized for the distance and pathway shown on the drawings.
- E. LAN Cabling: Comply with Division 27 Section "Data Cabling System"
 - 1. NFPA 262.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
 - 1. Record setup data for control station and workstations.

2. For each Location, record setup of Controller features and access requirements.
 3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 4. Set up groups, facility codes, linking, and list inputs and outputs for each Controller.
 5. Assign action message names and compose messages.
 6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 7. Prepare and install alarm graphic maps.
 8. Develop user-defined fields.
 9. Develop screen layout formats.
 10. Propose setups for guard tours and key control.
 11. Discuss badge layout options, design badges.
 12. Complete system diagnostics and operation verification.
 13. Prepare a specific plan for system testing, startup, and demonstration.
 14. Develop acceptance test concept and, on approval, develop specifics of the test.
 15. Develop cable and asset management system details, input data from construction documents. Include system schematics and Visio Technical Drawings.
- D. In meetings with Architect, Engineer, and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

- A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
- B. Install cables and wiring according to requirements in Division 27 Section "Voice and Data Cabling."
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- E. Install LAN cables using techniques, practices, and methods that are consistent with Category 6E rating of components and that ensure Category 6E performance of completed and linked signal paths, end to end.
- F. Install cables without damaging conductors, shield, or jacket.
- G. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- H. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.4 CABLE APPLICATION

- A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

- C. Card Readers and Keypads:
 - 1. Install number of conductor pairs recommended by manufacturer for the functions specified.
 - 2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire.
 - 3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
- D. Install minimum No. 18 AWG cable, bundled as specified, from Controller to electrically powered locks. Do not exceed 500 feet.

3.5 GROUNDING

- A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
- C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Bond shields and drain conductors to ground at only one point in each circuit.
- E. Signal Ground:
 - 1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - 2. Bus: Mount on wall of main equipment room with standoff insulators.
 - 3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 INSTALLATION

- A. Network Nodes: Install Access Control Panel (ACP) Network Nodes in CCTV, Video Surveillance, NVR, designated spaces.
 - 1. Install intermediate Network Nodes in data closets in data racks or on wall, as applicable.
- B. Provide 120V/20A power outlets at wall mounted node locations. Provide 120V circuit for each power outlet.
- C. Provide two data outlets at wall mounted node locations. Connect to the closest data rack.
- D. Push Buttons: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- high text and symbols as required. Push-button switches shall be connected to the Controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric bolt, or other facility release device.
- E. Install card readers.
- F. Install master intercom, push buttons, and door station to unlock door hardware.

3.7 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.
- B. Using cable and asset management software, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

- D. At completion, cable and asset management software shall reflect as-built conditions.

3.8 SYSTEM SOFTWARE AND LISENCES

- A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.
- B. Join all new access control system components with the S2 enterprise system including all licensing.
- C. Provide licenses for all the locations.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
 2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
 3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
- C. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.10 STARTUP SERVICE

- A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
1. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.11 PROTECTION

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. Refer to Division 1 Section "Closeout Procedures."
- B. Develop separate training modules for the following:
1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
 2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.

3. Security personnel.
 4. Hardware maintenance personnel.
 5. Corporate management.
- C. Individually train minimum five (5) staff members at each building to prepare and input credentials to man the control station and workstations and to enroll personnel.

END OF SECTION 282300

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SECTION 282300 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. This system shall provide all digital IP video surveillance, using cameras at the locations shown on the plans, from a central and remote monitoring stations.
- B. The central monitoring station shall include recorders, monitors, system power supplies and other related items as specified or required.
- C. The system shall be capable of recording minimum twenty (20) pictures per second per camera in twenty-four (24) hour mode and shall be adjusted initially for the twenty-four (24) hour mode.

1.2 DEFINITIONS

- A. AGC: Automatic gain control.
- B. CCD: Charge-coupled device.
- C. UPS: Uninterruptible power supply.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
 - 1. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 - 2. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - 3. Wiring Diagrams: Power, signal, and control wiring, and grounding.
 - 4. Certifications: Provide letters of certification indicating that the equipment supplier is a factory authorized representative and the personnel involved in installation have undergone factory-required training.
- C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.
- D. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, network video recorders, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.
 - 2. Service Centers: Provide list of authorized service centers where spare parts and repair services may be obtained. Include name, address and telephone number of nearest service representative responsible for warranty service.
 - 3. Certifications: Provide letter from manufacturer's authorized representative certifying that the installation was reviewed and has been installed and is functioning in accordance with these specifications, manufacturer's instructions and applicable codes.
- E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. The installer shall be an Avigilon certified company.

2. A company with minimum of five years of experience in installing video surveillance systems in educational buildings.
 3. The company shall be located within one hundred miles of the project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NECA 1.
- D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F and a relative humidity of 20 to 80 percent, non-condensing.
 2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosures.
 3. Interior, Uncontrolled Environment: System components installed in non- temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 3R enclosures.
 4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph. NEMA 250, Type 3R enclosures.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fixed Dome Cameras: Quantity three (3).
 2. 270 Degree Cameras: Quantity three (3).
 3. 360 Degree Cameras: Quantity three (3).

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
1. Warranty Period: One year from date of Substantial Completion.
 2. Contractor shall provide routine maintenance, adjustments and repairs during the one year warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide equipment manufactured by Avigilon. Each major component of this system, i.e. head end equipment, cameras, monitors, video recorders, shall be of a single manufacturer. Multiple manufacturers of a major component shall not be permitted.

2.2 SYSTEM REQUIREMENTS

- A. All electrical items shall be UL listed and installed in accordance with its listing and manufacturer's recommendations.

- B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
 - 1. Minimum Protection for Power Connections 120 V and More.
 - 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections.
- C. All equipment shall be provided by an authorized manufacturer's representative who shall be capable of providing maintenance and service on all equipment provided.

2.3 FIXED DOME CAMERAS

- A. The semi-flush-mounted vandal resistant cameras shall be an Avigilon model 6.0C-H6A-DC1, 6.0C-H6A-DP1, or 6.0C-H6A-DO1 as shown with minimum 4GB SD card. The camera shall incorporate a 1/3" interline transfer Super Dynamic III Progressive Scan CCD. The cameras shall have a sensitivity of 0.5 lux (with DNR on) with a clear dome.
- B. The camera shall use a Dual Streaming Codec with JPEG and H.264 Video Compression. Camera shall be capable of streaming up to 30fps.
- C. The camera's imager and lens assembly shall rotate on a three-axis hinge for optimal camera positioning. The camera shall be able to be semi-flush mounted on a wall or ceiling using a standard double-gang electrical box. The camera shall feature a rugged weatherproof exterior housing with an advanced dehumidification device, base and body as independent structures, and that meets IP66 rating. The vandal resistant camera shall feature a local monitor output jack for picture and positioning adjustments.
- D. The camera's Super Dynamic III CCD shall be charged with long and short charges, creating both standard shutter speeds and fast shutter speeds simultaneously, on a single image field. The Super Dynamic III CCD shall automatically apply each exposure pattern to bright and dark areas. The Super Dynamic III CCD shall feature images with a dynamic range of up to 128 times.
- E. The camera shall feature a body-based vandal automatic back focus mechanism for automatic and remote back focus adjustment. The automatic back focus adjustment (ABF) shall engage and reposition the imaging assembly for optimal focus position on automatic or manual switchover from Day to Night Mode and on manual activation at the camera or remote from the camera using a System Controller.
- F. The camera shall incorporate a CS-mount, 1/3", automatic iris, 2X variable focal lens with a focal length of 3.8-8mm (2.1X). The lens shall be suitable for use in areas where there is a varying light source. The lens shall have a maximum aperture ratio of 1:1.4 (wide), 1:1.8 (telephoto). The unit shall have an angular field-of-view of 35 degrees telephoto and 73 degrees wide (horizontal), and 26 degrees telephoto and 53 degrees wide (vertical). The camera shall also accept specific 1/3", vari-focal, auto iris lenses with varying focal lengths while continuing to allow the vandal automatic back focus mechanism to engage and reposition the imaging assembly for optimal focus position on automatic or manual switchover from Day to Night mode, and on manual activation at the camera or remote from the camera using a system controller.
- G. The power source shall be PoE (IEEE802.3af), which includes the operation of optional heater unit for exterior cameras.

2.4 270-DEGREE DOME CAMERAS

- A. The semi-flush-mounted vandal resistant mini dome cameras shall be an Avigilon model 15C-H5A-3MH with 4K resolution, and minimum 4GB SD card. The camera shall incorporate a 1/3" interline transfer CCD. The cameras shall have a sensitivity of 0.5 lux (with DNR on) with a clear dome.

- B. The camera shall use a Dual Streaming Codec with JPEG and H.264 Video Compression. Camera shall be capable of streaming up to 30ips.
- C. The camera's imager and lens assembly shall rotate on a three-axis hinge for optimal camera positioning. The camera shall be able to be semi-flush mounted on a wall or ceiling using a standard double-gang electrical box. The camera shall feature a rugged weatherproof exterior housing with an advanced dehumidification device, base and body as independent structures, and that meets IP66rating. The vandal resistant camera shall feature a local monitor output jack for picture and positioning adjustments.
- D. The camera shall feature a body-based vandal automatic back focus mechanism for automatic and remote back focus adjustment. The automatic back focus adjustment (ABF) shall engage and reposition the imaging assembly for optimal focus position on automatic or manual switchover from Day to Night Mode and on manual activation at the camera or remote from the camera using a System Controller.
- E. The camera shall incorporate a CS-mount, 1/3", automatic iris, 2X variable focal lens with a focal length of 3.8-8mm (2.1X). The lens shall be suitable for use in areas where there is a varying light source. The lens shall have a maximum aperture ratio of 1:1.4 (wide), 1:1.8(telephoto). The unit shall have an angular field-of-view of 35 degrees telephoto and 73 degrees wide(horizontal), and 26 degrees telephoto and 53degrees wide (vertical). The camera shall also accept specific 1/3", vari-focal, auto iris lenses with varying focal lengths while continuing to allow the vandal automatic back focus mechanism to engage and reposition the imaging assembly for optimal focus position on automatic or manual switchover from Day to Night mode, and on manual activation at the camera or remote from the camera using a system controller.
- F. The power source shall be PoE+ (IEEE802.3af).
- G. Provide POE60U-1BTE-R power injector with each 270-Degree dome camera.

2.5 360-DEGREE DOME CAMERAS

- A. The semi-flush-mounted vandal resistant Full HD mini dome color CCD cameras shall be an Avigilon model 8.0C-H5A-FE-DO1-IR with 4K resolution, and minimum 4GB SD card. The camera shall incorporate a 1/3" interline transfer CCD. The cameras shall have a sensitivity of 0.5 lux (with DNR on) with a clear dome.
- B. The camera shall use a Dual Streaming Codec with JPEG and H.264 Video Compression. Camera shall be capable of streaming up to 30ips.
- C. The camera's imager and lens assembly shall rotate on a three-axis hinge for optimal camera positioning. The camera shall be able to be semi-flush mounted on a wall or ceiling using a standard double-gang electrical box. The camera shall feature a rugged weatherproof exterior housing with an advanced dehumidification device, base and body as independent structures, and that meets IP66rating. The vandal resistant camera shall feature a local monitor output jack for picture and positioning adjustments.
- D. The camera shall feature a body-based vandal automatic back focus mechanism for automatic and remote back focus adjustment. The automatic back focus adjustment (ABF) shall engage and reposition the imaging assembly for optimal focus position on automatic or manual switchover from Day to Night Mode and on manual activation at the camera or remote from the camera using a System Controller.

- E. The camera shall incorporate a CS-mount, 1/3", automatic iris, 2X variable focal lens with a focal length of 3.8-8mm (2.1X). The lens shall be suitable for use in areas where there is a varying light source. The lens shall have a maximum aperture ratio of 1:1.4 (wide), 1:1.8(telephoto). The unit shall have an angular field-of-view of 35 degrees telephoto and 73 degrees wide(horizontal), and 26 degrees telephoto and 53degrees wide (vertical). The camera shall also accept specific 1/3", vari-focal, auto iris lenses with varying focal lengths while continuing to allow the vandal automatic back focus mechanism to engage and reposition the imaging assembly for optimal focus position on automatic or manual switchover from Day to Night mode, and on manual activation at the camera or remote from the camera using a system controller.
- F. The power source shall be PoE+ (IEEE802.3af).
- G. Provide POE60U-1BTE-R power injector with each 360-Degree dome camera.

2.6 CAMERA ACCESSORIES

- A. All indoor ceiling mounted cameras shall be provided with embedded ceiling mount bracket.
- B. All exterior mounted cameras shall have heater unit.
- C. All exterior corner mounted cameras shall be mounted with vandal-resistant corner mount bracket.

2.7 NETWORK VIDEO RECORDERS

- A. The Avigilon recorders shall be capable of connecting to up to 64 network cameras each without extra license fees and their images can be recorded simultaneously. Provide multiple recorders to accommodate all the cameras shown on the drawings plus ten (10) spare cameras.
- B. The recorders shall be equipped with minimum 94TB HDDs.
- C. They shall allow up to 94TB HDD storage to be installed in the main units.
- D. The total system shall have minimum 94TB HDD storage capacity.
 - 1. The HDD storage capacity shall allow minimum thirty-five days of record time for all the cameras connected to each recorder at an optimal rate of 20 frames per second with continuous 24/7 recording setting.
 - 2. The recording schedule shall be set for continuous 24/7 recording for all the cameras.
- E. The recorder shall be the equipment with an embedded real-time operating system and shall not be based on a Microsoft Windows OS. The OS must reside completely in the hardware and not be installed on the hard disk drives. Installed disk drives must be dedicated to recording videos.
- F. The recorders shall support H.264 and JPEG multi format.
- G. The recorders shall provide Various Recording Mode: Manual, Schedule, Event (Pre/Post), Emergency, and External Timer. It shall have the capabilities to control: Pan/Tilt, Zoom, Focus, Brightness and Preset Positions. It shall be able to search using Time & Date, Event Type and Camera number.
- H. The recorders shall have up to 8 recording programs including individual recording mode for each camera, and 6-time schedules per day.
- I. The recorders shall have up to 64 audio capabilities and can be recorded and played back at G.726 (ADPCM) 32 kbps.
- J. The recorders shall have 2x built-in Gigabit network interfaces (10Base-T / 100Base-TX / 1000Base-T) for camera recording and client access.
- K. The recorders shall have the quick discovery and IP setup function for network cameras.

- L. The recorders shall have the capabilities to transfer recorded images to FTP server upon alarm and/or live image periodically. Images recorded in the SD memory card in the i-Pro network cameras can be transferred to the recorder automatically even when the recorder is in recording status.
- M. The recorders shall have User/Host authentication, 4 programmable user levels, 16 user priorities and User-Camera View/Control partitioning setup for sophisticated user management. It shall be capable of up to 32 user registrations.
- N. The recorders shall have Alteration detection and recorded data encryption for data security.
- O. The recorders shall be viewable from any properly connected PC using Google Chrome and Fire Fox.
- P. The recorders shall provide user authentication and support different user privileges based on logon ID. From the client the user should (with proper authentication) be able to do the following:
 - 1. Setup cameras
 - 2. Define live viewing, recording rates and quality settings.
 - 3. Define recording programs and schedules.
 - 4. View live video in either single or quad views.
 - 5. Search and playback recorded video.
 - 6. Download selected recorded video.
 - 7. Control connected PTZ cameras.
- Q. Supported protocols: TCP/IP, UDP/IP, HTTP, FTP, SMTP, DHCP, DNS, DDNS, NTP, SNMP
- R. The power source shall be 120VAC, 60Hz at approx. 170W.
- S. Unit shall be mounted (EIA 19@ standard) either with mounting brackets or rack shelf.

2.8 HIGH-DEFINITION VIDEO MONITORS

- A. Provide a minimum 20" high-definition LCD video monitor with rack mountable accessories in a standard 19" rack panel for each network video recorder.
- B. The monitor shall have a 20" diagonal flat square screen with 1,600 x1,200 resolution. The monitor shall feature a control panel that can be locked to prevent unauthorized altering of the settings. The monitor shall feature on-screen display for adjustment of sharpness, brightness, picture, color, tint and volume.
- C. The monitor shall feature built-in speakers. Three audio and video inputs, DVI, HDMI, and S-video loop through (Mini-DIN 4-pin), and selectable 1/2/3/S-Video terminals shall be located on the rear of the monitor. The power source shall be 120VAC, 60HZ. The monitor shall be UL listed. Provide Avigilon monitors with rack mounting brackets.

2.9 CONTROL STATIONS

- A. Heavy-duty, freestanding, modular metal furniture units arranged to house standard mounting electronic equipment. Coordinate video surveillance component arrangement and wiring with components and wiring of other systems. The station shall include integrated work surface, pull out shelves for system keyboard and mouse. Basis of design is a minimum 7 feet high unit by Chatsworth Product Inc (CPI).
- B. Equipment Mounting: Standard 19-inch rack complying with EIA 310.
- C. Provide an AC outlet power strip containing a minimum of six outlets mounted vertically near the rear of the cabinet. Power strip shall be provided with a six-foot power cord rated for 20 amps at 120 volts. The strip shall be fused or have a circuit breaker as over-current protection. The power strip shall be MOV protected in three modes: L-N, N-G, L-G with a 300V clamping level. Each outlet shall be rated for 15 amps.

- D. Power Continuity for Control Station: Batteries in power supplies of central-station control units and individual system components shall maintain continuous system operation during outages of both normal and backup ac system supply.
 - 1. UPS: Self-contained static Uninterruptible Power Supply (UPS). Provide rack mountable UPS, APC #AMER PWR SMTL2000RM2UCNC with rack mounting and network monitoring accessories.
- E. Provide a standard unmodified PC with accessories and peripherals that configure the control station for a specific duty.
 - 1. Control Station Computer: Standard unmodified PC by DELL of modular design, OptiPlex Minitower or equal. The CPU operating speed shall be at least 3.0 GHz.
 - 2. Memory: 8 GB of usable installed memory.
 - 3. Power Supply: Minimum capacity of 250 W.
 - 4. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.
 - 5. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.
 - 6. Mouse: Standard, cordless, compatible with the installed software.
 - 7. Disk storage shall include the following, each with appropriate controller:
 - a. Minimum 1 TB SATA hard disks, maximum average access time of 3.0 Gb/s

2.10 RECORDING MANAGEMENT SOFTWARE

- A. Provide Avigilon software management and live monitoring software for the facilities department computer.
- B. The software shall be installed, configured, and all recorders connected on the facilities department dedicated computer per the Owner's instructions.

2.11 CABLES AND CONNECTORS

- A. All cables and connectors shall be in compliance with Section 271301 "Data Network."
- B. All cables shall be plenum rated.
- C. All cables shall be in conduit to and from cable tray or J-hook system.
- D. Provide weatherproof cables or weatherproof sleeving or conduit in exterior locations.

PART 3 - EXECUTION

3.1 VIDEO SURVEILLANCE SYSTEM INSTALLATION

- A. Install cameras level and plumb.
- B. Install cameras with 84-inch-minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.
- C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.
- D. Install power supplies and other auxiliary components at control stations, unless otherwise indicated.
- E. Avoid ground loops by making ground connections at only the control station.
- F. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
- G. Provide device identification label on each camera. The label shall be printed on laminated label tape.
- H. Cameras shall be grouped for display on video surveillance system monitors in accordance with the Owner's direction on each individual monitor.
- I. Provide 10 feet of extra cable at each camera, coiled above ceiling.

- J. Provide corner mount brackets for all exterior cameras shown to be corner mounted.
- K. Contractor shall relocate cameras up to 10 feet after original installation per Owner's request at no increase in contract price.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation and supervise pretesting, testing, and adjusting of video surveillance equipment.
- B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
- C. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video surveillance equipment for acceptance and operational testing as follows:
 - 1. Prepare equipment list described in Part 1 "Submittals" Article.
 - 2. Verify operation of auto-iris lenses.
 - 3. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - 4. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - 5. Set and name all preset positions; consult Owner's personnel.
 - 6. Set sensitivity of motion detection.
 - 7. Connect and verify responses to alarms.
 - 8. Verify operation of control-station equipment.
- D. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
- E. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
- F. Remove and replace malfunctioning items and retest as specified above.
- G. Record test results for each piece of equipment.
- H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- I. Upon completion of installation of all components and at substantial completion, repair or replace all damaged items. Surface scratches in painted enclosures shall be painted over. Deep scratches in metal enclosures or damage or defects in other items shall be replaced.

3.3 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions and to optimize performance of the installed equipment. Tasks shall include, but are not limited to, the following:
 - 1. Check cable connections.
 - 2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
 - 3. Adjust all preset positions; consult Owner's personnel.

4. Recommend changes to cameras, lenses, and associated equipment to improve Owner' utilization of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.4 CLEANING

- A. Clean installed items using methods and materials recommended in writing by manufacturer.
- B. Clean video surveillance system components, including camera-housing windows, lenses, and monitor screens.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to provide up to eight hours to train Owner's maintenance personnel to adjust, operate, and maintain video surveillance equipment.
 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
 3. Review equipment list and data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 4. The contractor shall coordinate the date of the training with the owner, in writing, a minimum of 15 days prior to substantial completion.
 5. At the end of the one-year warranty period, the manufacturer's representative shall, within 30 days of the expiration of the warranty period, provide up to eight hours of instruction in the operation and maintenance of the system to the owner's personnel.
 6. The owner shall be permitted to make a video and/or audio tape of the training sessions.
- B. Contractor and installer shall provide a letter certifying that the installation meets the applicable codes, plans and specification and was installed in accordance with manufacturer's instructions.

END OF SECTION 282300

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SECTION 283110 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fire alarm systems.
- B. Related Sections include the following:
 - 1. Division Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.2 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.3 SYSTEM DESCRIPTION

- A. Intelligent analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1.4 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Automatic sprinkler system water flow.
 - 5. Fire extinguishing system operation.
 - 6. Monitor module.
- C. Fire alarm signal shall initiate the following actions:
 - 1. Alarm notification appliances shall operate continuously.
 - 2. Identify alarm at the FACP and remote annunciator.
 - 3. De-energize electromagnetic door holders.
 - 4. Activate voice/alarm communication system.
 - 5. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 - 6. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
 - 7. Record events in the system memory.
 - 8. Call local fire department or others as directed by Owner.
- D. Supervisory signal initiation shall be by one or more of the following devices or actions:
 - 1. Operation of a fire-protection system valve tamper.
- E. System trouble signal initiation shall be by one or more of the following devices or actions:
 - 1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 - 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at the FACP.
 - 4. Ground or a single break in FACP internal circuits.
 - 5. Abnormal ac voltage at the FACP.
 - 6. A break in standby battery circuitry.
 - 7. Failure of battery charging.

8. Abnormal position of any switch at the FACP or annunciator.
- F. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
 1. Visual and audible trouble alarm at control panel and at remote annunciator panel.
 2. Manual ACKNOWLEDGE function at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.
 3. Lamp Test: Manual LAMP TEST function causes alarm indication at fire alarm control panel and at annunciator panel.
- G. Drill Sequence of Operation: Manual DRILL function causes ALARM mode operation to:
 1. Sound local fire alarm signaling devices and initiate voice evacuation without sending signal to Municipal Fire Department.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 2. Device Address List: Coordinate with final system programming.
 3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 4. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 5. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 6. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- D. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- E. Submit manufacturer's certificate that system meets or exceeds specified requirements.
- F. Submit a schedule of values in accordance with Section 01290 - Payment Procedures for the following fire alarm devices fully installed, programmed and displayed on graphic annunciator: smoke detector, heat detector, duct mounted smoke detector, door holder (magnetic), monitor module, interlock relay, sprinkler flow and tamper device connection, horn, horn/strobe, speaker/strobe, indicating strobe, manual pull station and emergency telephone handset (fire fighter).
- G. Submit shop drawings to the local authority having jurisdiction for the project records and permitting. Pay all associated fees and charges.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

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

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Duct Mounted Detectors: Quantity five (5).
 - 2. Indicating Strobes: Quantity five (5).
 - 3. Smoke and Heat Detectors: Quantity five (5) each.
 - 4. Speaker Strobes: Quantity five (5).

1.8 QUALIFICATIONS

- A. Installer: Company specializing in smoke detection and fire alarm systems with five years of experience. Installer shall be the manufacturer's factory authorized full-line distributor, no exceptions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. FACP and Equipment:
 - a. Edwards Systems Technology Inc. (EST4)
 - 2. Wire and Cable:
 - a. Comtran Corporation.
 - b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
 - c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
 - d. West Penn Wire/CDT; a division of Cable Design Technologies.
 - 3. Audible and Visual Signals:
 - a. Amseco; a division of Kobishi America, Inc.
 - b. Commercial Products Group.
 - c. Gentex Corporation.
 - d. System Sensor; a GE-Honeywell Company.

2.2 FACP

- A. Control Panel: Microprocessor controlled, addressable point analog fire alarm panel of modular construction with surface wall-mounted enclosure. Field programming shall be possible through an integral 80 character supervised alpha/numeric display and keypad.
- B. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, relays, alarm signaling devices and voice evacuation system. Include battery-operated emergency power supply with capacity for operating complete system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- C. Circuits:
 - 1. Detection Circuits: Supervised with alarm and trouble indication.
 - 2. Signal Circuits: Supervised signal module, sufficient for signal devices connected to system.
 - 3. Actuation of alarm notification appliances, emergency voice communications, annunciation, shall occur within 10 seconds after the activation of an initiating device.
 - 4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
- D. Notification-Appliance Circuit: Operation shall sound in a 60 beats per minute, march-time pattern.

- E. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, relays, alarm signaling devices and voice evacuation system. Include battery-operated emergency power supply with capacity for operating complete system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciator, after initiating devices are restored to normal.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.
- I. Voice/Alarm Signaling Service: A central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the Fire Command Center.
 - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones, or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall be UL 1711 listed.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.
 - 2. Notification-Appliance Circuits: NFPA 72, Class A or B.
 - 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- J. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.
 - 1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, and trouble signal shall be powered by the 24-V dc source.
 - 1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
 - 2. Power supply shall have a dedicated breaker for this connection at the service entrance equipment. Paint the breaker red and identify it with "FIRE ALARM SYSTEM POWER."

- L. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
 - 2. Battery and Charger Capacity: Comply with NFPA 72.
- M. Surge Protection:
 - 1. Install surge protection on normal ac power for the FACP and its accessories.
 - 2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP. The force to activate the device shall be no greater than five (5) lbf.
 - 2. Station Reset: Key- or wrench-operated switch.

2.4 SYSTEM SMOKE DETECTORS

- A. General Description:
 - 1. UL 268 listed, operating at 24-V dc, nominal.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
 - 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
- B. Photoelectric Smoke Detectors:
 - 1. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detectors:
 - 1. Ionization Smoke Detectors:
 - a. Sensor: Responsive to both visible and invisible products of combustion. Self-compensating for changes in environmental conditions.
 - b. Detector Sensitivity: Between 0.5 and 1.7 percent/foot smoke obscuration when tested according to UL 268A.
 - 2. UL 268A listed, operating at 24-V dc, nominal.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
5. Provide with auxiliary DPDT relay contact key-operated NORMA-RESET-TEST switch.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where indicated.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
8. Each sensor shall have multiple levels of detection sensitivity.
9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
10. Auxiliary contacts shall be rated minimum 4A at 28 VDC, 7.5A at 115 VAC.
11. Two-wire detector with common power supply and signal circuits.

2.5 MONITOR MODULE

- A. The monitor module shall be used to connect a supervised zone of conventional initiating devices (any N.O. dry contact device) to the system loop. The monitor module shall be addressable. An integral LED shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

2.6 HEAT DETECTORS

- A. General: UL 521 listed.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
 1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.7 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn not to exceed 120 dB maximum. Provide integral strobe lamp and flasher (minimum 1 Hz, maximum 3 Hz) with clear or nominal white lens with RED letter head FIRE on lens.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
 1. Rated Light Output: 75 candela.
 2. Strobe Leads: Factory connected to screw terminals.
 3. Minimum 1 Hz, maximum 3 Hz
- D. Voice/Tone Speakers:
 1. UL 1480 listed. (90 dBA at ten feet)
 2. Compatible with both 70V and 25V audio distribution systems.
 3. Speakers shall operate over frequency range of 400 – 4000 Hz.
 4. Mounting: Flush, semi recessed, surface mounted.

5. Matching Transformers: Tap range matched to the acoustical environment of the speaker location. Have separate terminals for ¼, ½, 1 or 2 watt operation. Set tap at ½ watt.
 6. Provide integral strobe lamp and flasher (minimum 1 Hz, maximum 3 Hz) with RED lettered FIRE on white lens where indicated. Finishes shall be RED enamel.
- E. Remote Annunciator: Provide a supervised remote 80 character, back-lit display annunciator including audible and visual indication of fire alarm by device or zone; and audible and visual indication of system trouble. Key enabled control switches shall permit ACKNOWLEDGE, SILENCE and RESET functions.

2.8 VOICE EVACUATION SYSTEM:

- A. Voice evacuation system shall provide an evacuation alarm signal and voice transmission over the fire alarm speaker and speaker-strobe devices. Unit shall be UL listed. The system shall be integrated within the 24 VDC fire alarm panel. Speaker lines shall be 25 V RMS and supervised for open or short circuit. Further the unit shall have the following features.
- B. Amplifiers, signal generator, power supply, output transformer and speaker lines shall be continuously supervised for normal operation, open or short circuit.
- C. Amplifiers shall be capable of withstanding a continuous output short circuit with alarm tone sounding without failure, fusing or shutdown.
- D. System shall be operable for non-emergency public address announcements without an alarm condition.
- E. Two-way telephone communication circuits shall be arranged so as to allow communication between the fire command center and up to seven (7) remote telephone locations simultaneously.
- F. Speaker line output shall include provision for class A or class B supervised speaker wiring.
- G. Amplifier shall be specifically designed for high-intelligibility speech reproduction and fire evacuation signaling.
- H. A prerecorded voice module shall be used to store tones and/or messages and transmit them over speaker circuits automatically upon alarm actuation. The voice module shall have no moving parts.
- I. Protection circuitry shall be included to prevent failure due to overloading, overheating, speaker line short circuit, over-voltage, and polarity reversal. Automatic current limiting shall keep circuitry within safe operating limits, without shutdown.
- J. Fixed Emergency Telephone Handset
 1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
 2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
 3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

2.9 REMOTE ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also, duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing. Unit shall be supervised 80 characters, back-lit display with audible and visual indication of system trouble.
 1. Mounting: Flush cabinet, (NEMA 250, Class 1) with keyed access.
- B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled according to UL 632.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by manufacturer of the device.
 - 2. Finish: Paint of color to match the protected device.

2.12 WIRE AND CABLE

- A. Fire alarm system initiating loop and signal circuit cables shall be UL listed NEC type FPL, power-limited cabling in accordance with this specification and NEC 760-55 through 58.
- B. Initiating and Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.

2.13 AUXILIARY DEVICES:

- A. Interlock Relays: Industrial duty, long life, encapsulated coil; 8A - 120 VAC, SPDT, silver power contacts; in NEMA 1 enclosure. Relay shall be U.L. listed. Install such that no high voltage wiring will be in the same conduit with the fire alarm system wiring.
- B. Sprinkler Water Flow Alarm Switches: The Sprinkler Water flow alarm and tamper switches shall be provided by others.
- C. City Fire Department Connection: Two telephone connections shall be utilized between this facility and the local Fire Department or as directed by Owner. Provide and install a dual line Digital Communicator/Transmitter within the control panel.
- D. Strobe Synchronization Modules: The strobe synchronization modules shall be provided to enable all strobes within a field of view to flash synchronously.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Installation shall be in strict compliance with manufacturer's recommendations. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing conduits and pulling wire.
- B. Smoke or Heat Detector Spacing:
 - 1. Smooth ceiling spacing shall not exceed 30 feet.
- C. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
- D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.
- E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

- F. Install manual station and emergency telephone 48" above floor.
- G. Install audio-visual and visual only signal devices 80" above floor.
- H. Device Location-Indicating Lights: In accordance with Georgia Accessibility Code visual signal appliances shall be installed in each of the following areas.
 - 1. Restrooms and any other general usage areas (e.g., classrooms, meeting rooms)
 - 2. Hallways, lobbies and any other area of common use.
- I. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.
- J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- K. All Equipment shall be held firmly in place. Fastening and supports shall be adequate to support the loads with a reasonable safety factor.
- L. All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual trouble signal will be activated until the system is restored to normal.
- M. Make conduit and wiring connections to sprinkler flow switches, sprinkler valve tamper switches, HVAC shut-down relay, smoke damper relays, master intercom interface relay, etc.

3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."
 - 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

- D. Identify conduit in as specified in Section 260533.

3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing.
- B. Perform the following field tests and inspections and prepare test reports:
1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
 - a. Include the existing system in tests and inspections.
 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
 5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- B. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

3.8 WARRANTY:

- A. Guarantee on-site response to a trouble call within twenty-four (24) hours after receipt of such call.
- B. Make available to the owner an authorized and trained service representative who will provide maintenance during normal working hours at no cost to the Owner for a period of twelve (12) months from the date of acceptance.

END OF SECTION 283110