PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section and to all following sections within Division 28.

1.02 DESCRIPTION OF WORK

A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation, and utilities.

B. Division 28 of these Specifications, and Drawings numbered with the prefix TY generally describe these systems, but the scope of the Electronic Safety & Security Work includes all such Work indicated in the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing, Electrical and Telecommunications Drawings and Specifications; and Addenda.

C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets, and cabling without showing all the exact details as to elevations, offsets, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

D. Specifications, along with the device schedules located on drawing legend sheets, define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.03 ABBREVIATIONS

ADA	Americans with Disabilities Act
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ETL	Electrical Testing Laboratories, Inc.
FCC	Federal Communications Commission

FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineers
LED	Light Emitting Diode
NEC	National Electric Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies
NRTL	Nationally Recognized Testing Laboratory
OEM	Original Equipment Manufacturer
OFCI	Owner Furnished Contractor Installed
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories
UON	Unless Otherwise Noted

1.04 QUALITY ASSURANCE

A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workpersons duly trained to perform the Work specified.

B. Qualifications – refer to individual Division 28 sections for specific Personnel and Contractor Qualifications.

C. Install all Work in strict conformance with all manufacturers' requirements and recommendations unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation.

D. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size, and capacity. Provide all material and equipment of the same type from the same manufacturer.

E. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

F. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations, and requirements of the service providers serving the project and the Owner’s insurance underwriter.

G. Drawings, specifications, codes, and standards are minimum requirements. Where requirements differ, the most stringent apply.

H. Should any change in drawings or specifications be required to comply with governing regulations, notify and receive written approval from the Architect prior to submitting bid.

I. All equipment and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, NEC, NEMA, NFPA, OSHA, UL, and the State Fire Marshall.

J. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced, full-time Project Manager who is authorized to make decisions on behalf of the Contractor.

K. Warranty Requirements

1. Refer to Division 1 and General Conditions for Warranties.
2. Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a minimum period of 12 months from date of Substantial Completion, or longer where specific items are required to carry a longer warranty in these Construction Documents or a manufacturer's standard warranty exceeds the minimum. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 1.
3. Refer to individual Division 28 sections for additional warranty requirements, as certain components and systems will have warranty requirements that exceed 12 months.
4. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.
5. Schedule repairs with the Owner for times of the day, days of the week as specified by the Owner. No premiums shall be charged to the Owner for work requiring weekend or after "normal business hours" access.
6. Perform the remedial work within 48 hours, upon written notice from the Architect or Owner, unless deferred by the Owner.
7. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.05 CODES, REFERENCES, AND STANDARDS

A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes.

B. Bring all perceived conflicts between codes, ordinances, rules, regulations and these documents to the Architect's and Design Consultant's attention in sufficient time, prior

to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

1. If a conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Design Consultant, without additional compensation. Contractor will be held responsible for any violation of the law.

C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.

D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes. Refer to individual sections for exact codes, references, and standards.

1.06DEFINITIONS:

A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:

1. AHJ - The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
2. Approved - Labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
3. As Directed - As directed by the Architect, or the Contractor representative.
4. Concealed - Embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed within hung ceilings.
5. Conditionally Approved – The manufacturer has been found reputable by the design professional, but the design professional has not verified that the product offering by manufacturer meets to all specification requirements. Contractor shall adhere to submittal review process for final approval on products.
6. Design Consultant - Where referenced in this Division, “Design Consultant” is the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions.
7. Furnish - “To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations.” When ‘furnish’, ‘install’, ‘perform’, or ’provide’ is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.
8. Furnished by Owner (or Owner-Furnished) or Furnished by Others: “An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.”
9. Install - “To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing,

commissioning, starting up and similar operations, complete, and ready for the intended use."

10. NRTL - Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTL's that are acceptable to the AHJ, and standards that meet the specified criteria.
11. Provide - "To furnish and install complete, and ready for the intended use."
12. Prime Contractor – a project's overall contractor responsible for all Divisions of Work, usually identified as a General Contractor or Construction Manager At Risk.
13. Submit - Submit to Architect for review.
14. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.
    a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
    b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.
15. Value Engineering: A systematic method to improve the "value" of goods and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. The goal of VE is to achieve the desired function at the lowest overall cost consistent with required performance.
16. Wet Location - A location subject to saturation with water or other liquids. Pathways installed in wet locations do not protect cables from moisture such that cables installed in pathways within wet locations must be identified by tfr manufacturer for use in wet locations.
    a. For example: Slab-on-grade construction where pathways are installed underground or in or under concrete slabs that are in direct or indirect contact with soil (e.g., sand and gravel with or without a moisture barrier) is considered a "wet location."
17. (*) – Where appearing in product part or model numbers; shall represent wild card character to be filled in by the contractor to meet required specifications.

B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by, or acceptable to, the Design Consultant as equivalent to the item or manufacturer specified".

1.01 COORDINATION

A. Coordinate with other Divisions for Electronic Safety and Security work to be included but not listed in Division 28 or indicated on the Security or Fire Alarm Drawings.

B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.

C. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Follow these drawings as closely as the actual construction and the work of other trades will permit.

D. Maintain a project manager, as specified by the Quality Assurance sections of these specifications, always on the jobsite to coordinate this Work with other trades so that various components of the Division 28 systems are installed at the proper time, fits the available space, allows proper service access to all equipment, and meets all required codes and standards.

E. Execute the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.

F. Work of this Division shall progress according to the "Construction Schedule" as described in Division 1 and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule to ensure successful achievement of all schedule dates.

G. Carefully check space requirements with other trades to ensure that equipment can be installed in the spaces allotted.

H. Refer to Coordination requirements in specific sections for additional information.

I. Examine and compare the Contract Drawings and Specifications with the Drawings and specifications of other trades and report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

J. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of Record Drawings.

K. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections shall be made or which shall be changed or altered.

L. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Architect.

1.02MEASUREMENTS AND LAYOUTS

A. The Drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.03SUBMITTALS

A. Refer to Division 1 and General Conditions for general submittal requirements in addition to requirements specified in this section. Refer to individual Division 28 Sections for additional submittal requirements. Unless otherwise noted, it is acceptable to submit electronic, PDF files.

B. Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, the license agreement for transfer of information obtained from the Engineer must be used.

C. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.

D. Unless noted otherwise within each individual section, submittals shall be provided for approval in four distinct submittal stages:

1. Pre-bid Submittal

    a. Generally means submittals required no less than two weeks prior to the due date for the submission of bids, such as:

        1) Product substitutions approved alternate or equivalent requests to be reviewed for approval (Prior to Bid). Coordinate with Division 1.
        2) Alternate personnel credentials to be reviewed for approval

2. Bid Submittal

    a. Generally means submittals required at the time of the submission of bids, such as:

        1) Unit Pricing (if required by sections in this Division)
        2) Personnel Qualifications
        3) Contractor Qualifications
        4) Voluntary Bid Alternates

3. Pre-Construction Submittal

a. Generally means submittals required after the award of the project to the winning bidder and prior to starting construction. At a minimum, Pre-Construction submittals shall include:

1) The project name
2) The submitted contractor's company name, the individual's name responsible for the submittal, and contact information for that individual
3) The Prime Contractor's stamp, which shall certify that the stamped submittals have been check by the Prime Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.

b. Submittals for this division shall be divided and titled in the following manner:

1) Division 28 Electronic Security Systems
2) Division 28 Fire Alarm Systems
3) Division 28 Mass Notification System
4) Division 28 Distributed Antenna System for Public Safety Radio Coverage

c. Submit the following items within 4 weeks after the notice to proceed:

1) Division of Labor amongst sub-contractors. Include:

a) Information on each sub-contractor:

i) Company Name
ii) Address
iii) Name of project manager for this project, including:

(1) E-mail
(2) Telephone number

b) A detailed description or matrix identifying who is responsible for furnishing, installing, and verifying the following system components:

i) General requirements:

(1) Various system power, backup power, and grounding/bonding items.
(2) Various conduit and other common work items.
(3) Various low-voltage wires/cabling and terminations.
(4) Various structural and seismic items (including design)

ii) Individual Division 28 sections

2) Updated Personnel and Contractor Qualifications (resubmit if there are no changes)
3) Schedule - A Gantt chart or Milestone list that includes the following timetables:

a) Pre-Construction Submittals

i) Include time for resubmittals
ii) Unless otherwise stated elsewhere within these specifications, assume 1 week review time for the Prime Contractor and 2 weeks

for the Architect/Division 28 Design Consultant for each submittal.

b) Material purchase/shipping schedules (to identify any long lead times for critical components)
c) Conduit Installation
d) Cabling Installation
e) Cabling termination and testing
f) Power and backup power availability
g) Equipment installation and testing
h) System startup and configuration
i) As-built drawings
j) Operation and Maintenance Manual submission, resubmission, and approval
k) Final Site Observation for Substantial Completion approval to be at least 2 weeks prior to overall project Substantial Completion date
l) Owner Training sessions
m) Other items as required by individual sections in this Division

4) Equipment List - A typed list, indexed by Specification section, of products specifically identified by part number (no wild card characters) within each specification section in this Division. Products are to be listed in the same order as in the specification. List is to include length of manufacturer warranty for each product.
5) Data Sheets - Manufacturers' data-sheets:

a) At a minimum all product data-sheets shall contain the following:

i) The manufacturers' name and logo somewhere on the page
ii) All parts, pieces, and equipment submitted for review shall be identified specifically by stamp or highlighted in such a manner that the product(s) being considered are clearly identifiable and distinguished from all other materials, parts or equipment that may be on the submittal.
iii) For data-sheets with accessories, additional parts, or derivations of the product being submitted all shall be clearly identified for the reviewer and acceptance.
iv) Sufficient detail for reviewer to identify all required information, such as size, weight, color, NRTL listings, approval or certification information, and other necessary identifying information to confirm product meets specifications.

b) Data-sheets are to be in the same sequential order as is presented within the specifications.

6) Warranty Information – For warranties required by this specification and other Related Sections, submit warranty terms and conditions for each system or product. These shall contain the following:

a) Length of warranty period

b) What is covered
c) All disclaimers, limitations, etc.
d) What, if anything, is not covered?

7) Samples – refer to individual sections for exact sample requirements.

a) Samples requested shall be physical examples that represent materials, equipment or workmanship and establish standards by which the work will be judged. Contractor or Manufacturer is to cover return shipping if sample is to be returned.

8) Shop Drawings – Refer to individual sections for exact Shop Drawing requirements.

d. And as required by individual sections in this Division

4. Project Completion Submittal

a. Generally means, unless otherwise noted, submittals required to be submitted 4 weeks prior to Substantial Completion, for the Design Consultant to reference during the "Final Punch" Site Observation. Project Completion, aka "Close-out Documents" include the following:

1) Record Drawings
2) Operation and Maintenance Manuals – refer to "Operations and Maintenance Data" section below.
3) Owner training syllabus
4) Recorded Owner Training
5) Project test reports
6) Cable Databases (as applicable)
7) Warranty Certificate(s)
8) And as required by individual sections within this Division

E. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 1. Contractor shall notify the Architect and Design Consultant that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 1, Contractor shall include the website, username and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Design Consultant's designated representatives. Contractor shall allow the Design Consultant review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

F. Identify each sheet of printed submittal pages (using arrows, highlighting, underlining, or circling) to show applicable sizes, types, model numbers, ratings, capacities, and options being proposed. Cross out or line-through non-applicable information. Note specified features such as materials or paint finish.

G. Provide submittals in sufficient detail to demonstrate compliance with these Contract Documents and the design concept.

H. Transmit submittals as early as required to support the project schedule. Allow two weeks Design Consultant review time, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before construction starts.

I. No part of the work shall be started in the shop or in the field until the shop drawings and /or samples for that portion of the work have been submitted and accepted.

J. Before transmitting submittals and material lists, verify that the equipment submitted is compatible with and suitable for the intended use. Verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

K. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

L. Submittals shall contain the following information. Submittals not so identified will be returned to the Contractor without action:

1. The project name
2. The applicable Specification Section
3. The submittal date
4. The submitting contractor’s company name and the project manager’s name and contact information.

M. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.

N. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, piping, and service connection data.

O. The Design Consultant’s checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless the Contractor has, in writing, called the Design Consultant’s and Architect’s attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve the Contractor from responsibility for errors in dimensions,

details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.

P. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.

Q. Maintain a complete set of reviewed and stamped shop drawings and product data on site.

R. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.

1.04ELECTRONIC DRAWING FILES

A. AutoCAD

1. In preparation of shop drawings or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall request and complete the Electronic File Release Agreement form from the Engineer. Send the form along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and Engineer's release agreement form must be received before electronic drawing files will be sent.

1.05 SUBSTITUTIONS

A. Refer to Bid documents, General and Supplementary Conditions and Division 01 Specification Sections for limitations and restrictions on substitutions in addition to requirements specified in this section.

B. For products, materials, equipment, or systems for which this Division specifically identifies, the Contractor shall use it as the basis for their bid. However, if the Contractor feels a substitute is appropriate for consideration they may submit, as required in these documents prior to bid, for approval by the Design Consultant.

C. Materials, products, and equipment described in the Bidding Documents establish a standard of required function, performance, dimension, appearance, and quality to be met by the proposed substitution.

D. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.

E. Request for Substitution:

1. Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.
2. The burden of proof of the merit of the proposed substitution is upon the proposer.
3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:

    a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
    b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
    c. Proposed substitution has received necessary approvals of authorities having jurisdiction.
    d. Same warranty will be furnished for proposed substitution as for specified Work.
    e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
    f. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

F. Substitution Consideration:

1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.
2. No substitutions will be considered with receipt of Bids unless the Architect and Design Consultant have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids and have approved the substitution request.
3. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work of related trades are not permitted.
4. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the performance as stated or implied in the Contract Documents.
5. No substitutions will be considered after receipt of Bids and before award of the Contract.

1.06 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1 and General Conditions for Operation and Maintenance Data.

B. Prior to Substantial Completion of the project, furnish to the Architect, for Design Consultant's review, and for the Owner's use, the following Division 28 items:

1. An electronic PDF file containing:

    a. A parts list of all equipment installed
    b. Equipment data-sheets for all equipment installed,

c. Summary of all settings and configurations for each piece of installed equipment
d. Listing of all software and versions install
e. All software licensing information
f. Record Drawings completed in electronic format, updated from submitted Shop Drawings,
g. Manufacturer's service and maintenance data,
h. Warranty certificates
i. Include local contacts complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.

2. One physical printed copy of electronic PDF file for the Owner's use, submitted in a three-ring, loose-leaf, hard-back notebook form (binder), divided and tabbed.

C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.

D. Refer to individual sections in this Division for additional requirements.

1.07 APPROVED EQUIVALENTS

A. For specific products, materials, equipment, or systems for which this Division specifically identifies the Contractor shall use as the basis for their bid. Where the term approved equivalent or equal is listed the contractor may submit documentation for review by the Design Consultant for approval. The Design Consultant's acceptance or rejection is final.

1.08 RECORD DRAWINGS

A. Refer to Division 01 and General Conditions for Record Drawings in addition to requirements specified in this section.

B. Maintain daily a set of jobsite work prints of the Issued for Construction Drawings, reflecting an accurate dimensional record of deviations between work shown on Drawings and that installed.

1. Record dimensions clearly and accurately to delineate the work as installed; suitably identify locations of all equipment by at least two dimensions to permanent structures.
2. Pay particular attention to those items that require locating for servicing. This includes, but is not limited to, above-ceiling items such as:

a. Cable and conduit routing
b. Pullbox and junction box locations

C. At the completion of the project, obtain reproducible electronic copies of the final Drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done electronically in AutoCAD, Revit, Adobe PDF and saved to

PDF and AutoCAD 2007 dwg format. Mark each sheet "Record Drawing", along with the date, and deliver these Record Drawings to the Architect.

1. PDF versions of the drawings shall have searchable text. “Flattened” PDFs will not be acceptable.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 and General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.

B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.

C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations and always take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect and Design Consultant.

D. Be responsible for the safe storage of tools, material, and equipment.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Use only products listed for their intended use by a NRTL, except products for which no relevant standards exist.

B. Where products are required to be NRTL listed, classified, approved or otherwise each individual item shall bear the NRTL mark by permanent means.

C. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.

D. Products and materials shall not contain asbestos, PCB, or any other material, which is considered hazardous by the Department of Environmental Protection or any other authority having jurisdiction.

E. As directed by the Architect, replace materials of less than specified quality and relocate work incorrectly installed.

F. Refer to individual sections for labeling requirements.

G. Install materials and equipment with qualified trade people.

H. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

I. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.

J. Where factory testing of equipment is required to ascertain performance and attendance by the Owner's representative is required to witness such tests, associated travel costs and subsistence shall be paid for by the Contractor.

K. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be de-rated with the method of de-rating identified on the submittals.

L. Enclosures for Electronic Safety and Security Infrastructure/equipment installed in mechanical equipment rooms shall be NEMA type 1 gasketed. Enclosures for Electronic Safety and Security Infrastructure/equipment installed outdoors shall be NEMA type 3R.

M. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of product data submittal.

N. Ship and store all products and materials in a manner that will protect them from damage, weather, and entry of debris. If items are damaged, do not install, but take immediate steps to obtain a replacement. Repairs of damaged goods will only be permitted with prior written permission of the Owner/Design Consultant.

O. Part numbers and product codes in these specifications are correct as of the time of writing. Manufacturers may, however, change part numbers and product codes on short notice. In cases where part numbers or product codes differ from technical specifications for a particular product, provide products meeting the minimum technical specifications of the products in the specifications. Notify the Owner/Design Consultant of any product code and or part number changes on the material list submittal.

PART 3 - EXECUTION

3.01FEES AND PERMITS

A. Secure and Pay all required fees and obtain all required permits related to the Electronic Safety and Security Systems' installation.

B. Pay royalties or fees in connection with the use of patented devices and systems.

3.02 CLEANING

A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.

B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises vacuum clean. Clean all material and equipment installed under this Division.

C. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.

D. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.

E. Touch up and restore damaged finishes to their original condition.

F. All Electronic Safety and Security infrastructure and equipment shall be thoroughly vacuumed and wiped clean prior to startup and at the completion of the project. Equipment shall be opened for observation by the Architect as required.

3.03DELIVERY, DRAYAGE AND HAULING

A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required and provide proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.

B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, then Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer’s supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.04EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost to the Owner.

B. Take responsibility for work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment to moisture damage in dry, heated spaces.

C. Provide adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.

3.05 CONNECTED PRODUCTS CYBER- SECURITY

A. Software Requirements

1. All firmware in products furnished or provided by the Contractor shall be the latest and most up-to-date provided by the manufacturer.
2. All equipment requiring users to log on using a password shall be configured with user/site-specific passwords). No system/product default passwords shall be allowed. Coordinate user logins and passwords with Owner prior to system setup.

    a. Passwords shall always be guarded and protected, including during construction phase of the project. Passwords shall not be written on or in any device, enclosure, or room where access could be obtained by others.
    b. Passwords shall be transmitted to owner, and Design Consultants via secure methods, obscuring or encrypting the document to be transmitted. This document shall be secured while stored for submission with the project(s) other submittals, including Shop Drawings and As-Built documentation.

3. Refer to individual sections for additional software requirements.

B. Network and Cybersecurity Requirements

1. For all Electronic Security Systems that have Contractor-provided equipment with an Ethernet/LAN port, Contractor shall coordinate with Owner's IT staff regarding Owner's network and cyber security requirements.
2. The Contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owner's technology infrastructure and network. These measures shall include but are not limited to:

    a. Coordinate with the manufacturer to ensure newly procured equipment does not have any cybersecurity notices, bulletins, or alerts. Provide a letter to the Design Consultant with the submittal documents for that Specification section confirming there are no active or known cyber threats.
    b. Ensure all installers/technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics.
    c. The Contractor shall assess any cyber threats / vulnerabilities associated with the specified equipment, prior to procurement/installation. If cyberthreats are discovered, notify the Design Consultant within one Day. Provide the make and model of the associated equipment and the vulnerability.
    d. Follow additional cybersecurity requirements and procedures as directed by the Owner's IT staff.

C. Refer to individual sections for additional Networking and Cybersecurity Requirements.

3.06 ADJUSTING, ALIGNING AND TESTING

A. Adjust, align, and test all Electronic Safety and Security infrastructure and equipment furnished and/or installed under this Division.

B. Check and test protective devices for specified and required application and adjust as required.

C. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.

D. Notify the Architect immediately of all operational failures caused by defective material, labor, or both.

E. Refer to individual Sections for additional and specific requirements.

3.07 START-UP OF SYSTEMS

A. Prior to start-up of Electronic Safety and Security systems, check all components and devices, to confirm compliance with manufacturers' recommended installation procedures.

B. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.

C. Refer to individual Sections for additional and specific requirements.

3.08 OPERATING INSTRUCTIONS

A. Instruct Owner's operating and maintenance personnel in proper starting sequences, operation, shutdown, general maintenance, and preventative maintenance procedures, including normal and emergency procedures.

B. Refer to individual Sections for additional and specific requirements.

3.09 SUBSTANTIAL COMPLETION REVIEW

A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:

1. Submit complete Operation and Maintenance Data.
2. Submit complete Record Drawings.
3. Perform all required training of Owner's personnel.
4. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
5. Perform start-up tests of all systems.
6. Remove all temporary facilities from the site.
7. Comply with all requirements for Substantial Completion in the Division 1 and General Conditions.

B. Request in writing a review for Substantial Completion. Give the Architect at least seven (7) days' notice prior to the review.

C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.

D. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.

E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, then provide reimbursement to the Architect and Design Consultant for time and expenses incurred for the visit.

F. Upon completion of the review, the Architect and Design Consultant will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.

G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.

H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

3.010 EARLY OCCUPANCY

A. Failure to meet the Substantial Completion date can result in the Owner needing to take early occupancy. Complete the systems which are necessary to allow partial early occupancy of the building by original Substantial Completion date.

   1. Refer to individual sections for additional requirements.

B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

END OF SECTION

SUBSTITUTION REQUEST FORM

To Project Engineer: _____ Request # (GC Determined): _____

Project Name: _____

Project No/Phase: _____ Date: _____

Specification Title: _____

Section Number: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

_____

Manufacturer: _____ Model No.: _____

Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified Work: _____

_____

☐ Point-by-point comparative data attached – REQUIRED BY ENGINEER
Comparative data may include but not be limited to performance, certifications, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements. Include all information necessary for an evaluation.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other: _____

Reason for not providing specified item: _____

_____

Similar Installation:
Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain: _____

_____

_____

Substitution Certification Statement:

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner that the:

A. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
B. Proposed substitution is consistent with the Contract Documents and will produce indicated results.
C. Proposed substitution does not affect dimensions and functional clearances.
D. Proposed substitution has received necessary approvals of authorities having jurisdiction.
E. Same warranty will be furnished for proposed substitution as for specified Work.
F. Same maintenance service and source of replacement parts, as applicable, is available.
G. Proposed substitution will not adversely affect other trades or delay construction schedule.
H. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

_____	_____	_____
Submitting Contractor	Date	Company

Manufacturer's Certification of Equal Quality:

I _____ represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to Architect, Engineer, and Owner that the function and quality of the Proposed Substitution meets or exceeds the Specified Item.

_____	_____	_____
Manufacturer's Representative	Date	Company

Engineer Review and Recommendation Section

Recommend Acceptance	☐ Yes	☐ No
Additional Comments:	☐ Attached	☐ None

Acceptance Section:

_____	_____	_____
Contractor Acceptance Signature	Date	Company
_____	_____	_____
Owner Acceptance Signature	Date	Company
_____	_____	_____
Architect Acceptance Signature	Date	Company
_____	_____	_____
Engineer Acceptance Signature	Date	Company

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. This Section includes general construction materials and methods, electronic security equipment coordination, and common Electronic Security Systems installation requirements as follows:

1. Pathways
    a. Conduit
    b. Outlet Boxes
    c. Pull Boxes
2. Grounding and Bonding
3. Firestopping Systems
4. Access Panels
5. Identification

B. *Note* Refer to Division 28 Section “Common Work Results for Fire Alarm Systems” for common work requirements for fire alarm systems. This section specifies the common work requirements of all other Division 28 sections.

1.2 RELATED SECTIONS

A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Division 28 Section “General Electronic Safety and Security Requirements”

B. Firestopping requirements listed in this section are unique to Division 28 Work. Refer to Division 07 Section “Penetration Firestopping” for general and additional firestopping requirements.

C. Refer to Division 26 for materials and methods for additional requirements for the following:

1. Division 26 Section “Common Work Results for Electrical” for electrical systems coordination.
2. Division 26 Section “Equipment Wiring Systems” for electrical systems coordination.
3. Division 26 Section “Grounding and Bonding for electrical systems” for electrical systems coordination.
4. Division 26 Section “Hangers and Supports for Electrical Systems” for electrical systems coordination.
5. Division 26 Section “Raceways and Boxes for Electrical System” for electrical systems coordination.
6. Division 26 Section “Cable Tray” electrical systems coordination.

7. Division 26 Section “Underfloor Raceways for Electrical Systems” electrical systems coordination.
8. Division 26 Section “Underground Ducts and Raceways for Electrical Systems” for electrical systems coordination.

1.3 CODES, STANDARDS, AND GUIDELINES

A. Follow all applicable codes, references, and standards listed in Division 28 Section “General Electronic Safety and Security Requirements”.

B. Follow all guidelines listed in Division 28 Section “General Electronic Safety and Security Requirements”.

C. Follow the correct revision or printing (UON) of all applicable codes, references, standards, and guidelines.

D. Follow the additional codes, references, standards, and guidelines:

1. Follow the additional codes, references, standards, and guidelines:

a. For Telecommunications Infrastructure (Category 5e/6/6A and fiber optic cabling) required by this division:

1) ANSI/TIA/EIA-569-C – “Commercial Building Standard for Telecommunications Pathways and Spaces”

b. For Firestopping installed by this division:

1) ASTM E 814 and ANSI/UL1479 – “Fire Tests Through Penetration Firestops”
2) ASTM E 84 and ANSI/UL 723 “Surface Burning Characteristics of Building Materials”
3) ASTM E 119 and ANSI/UL 263 “Fire Tests of Building Construction Materials”

1.4 QUALITY ASSURANCE

A. Install all Work in strict conformance with all manufacturers' requirements and recommendations unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.

B. Firestopping Systems

1. Firestopping material and systems shall be tested and listed by UL. All firestopping products shall bear this classification marking.
2. Installation technicians shall be by qualified and trained personnel. Acceptable installer qualifications are as follows:

a. FM Research approved in accordance with FM AS 4991.

b. Individuals who are trained and certified by the firestopping manufacturer. For Specified Technologies, all installers shall have current FIT Level 1 certification.

1.5 SUBMITTALS

A. Follow the requirements for submittals in Division 28 Section "General Electronic Safety and Security Requirements".

B. The following submittals are due as part of the Pre-Bid Submittal:

1. For all products for which a substitute is to be considered as an approved equivalent or acceptable substitution, provide submittals with sufficient detail for review by the Design Consultant. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information. Be prepared to submit a sample should the Design Consultant request an evaluation.

C. The following submittals are due at the Pre-Construction Submittal:

1. Contractor Qualifications (for Firestopping Systems): Provide copies of training/certification as required in the Quality Assurance portion of this specification section.
2. Parts List: Provide a typed list indicating part name, manufacturer, part number, and color (if applicable) for products specifically identified herein by the exact and complete part number (no wild-card characters).
3. Submit manufacturers' cut sheets or catalog cut sheets of each of the pathways not specifically identified by its exact part number:
    a. Cut sheets shall include the following information at a minimum:
        1) Manufacturers name and logo
        2) Size – including physical and loading dimensions
        3) Maximum span length
        4) Weight supported
        5) Type
        6) Fittings to be used
        7) Method of attachment to structure
        8) Firestop system assembly information for each system to be installed:
            a) Documentation from UL catalog for each system proposed. This documentation shall include the following information:
                i) Firestop manufacturer
                ii) UL system number
                iii) F, T, and L Ratings
                iv) The complete description of the firestop system; To include what specific construction the system is intended to pass through such as a wall or floor assembly, the penetrating items allowed to pass through the opening in the wall or floor assembly, and the

materials designed to prevent the spread of fire through the openings.

4. Shop Drawings:
    a. Submit for review scaled layout drawings showing the size/routing of all pathways and the size/information/locations of all boxes, pullboxes, firestopping systems, and access panels.
        1) Each pathway shall be identified by type and size on the drawings.
            a) Example #1: 4" EMT
            b) Example #2: 2" IMC
        2) Each grounding conductor shall be identified by size (and insulation):
            a) Example: #3/0 insulated ground
        3) Each firestop system shall be identified by Manufacturer and Product, as well as UL system number for that location.
            a) Example #1 – Firestopping Sleeve: EZ-Path Series 22, UL System W-L-3255
            b) Example #2 – Backbox in Fire-Rated Wall: Specseal Power Shield, UL System QCSN/CLIV.R14288
        4) Each pullbox and access panel shall be identified by size and height above finished floor.
            a) Pullbox Example: Pullbox 8" x 24" x 40" approximately 12' AFF.
    b. Include pathway systems (conduit, cable tray, auxiliary supports, etc.) and other common work on the same shop drawings for Division 28 "Electronic Security Systems".
        1) The following submittals are due at the Project Completion Submittal:
            a) Record Drawings:
                i) Based on the work prints kept on the jobsite and official changes to the Contract Documents (such as Change Orders, Architect's Supplemental Instructions, and Design Change Directives), create final drawings incorporating any minor and approved changes to the submitted Shop Drawings. Submit this set in accordance with the Record Drawings requirements of Division 28 Section "General Electronic Safety and Security Requirements".
            b) Keys – Supply two copies of every key as required for pullboxes, junction boxes, and access panels.

1.6 DEFINITIONS

A. Conditionally Approved - the manufacturer has been found reputable by the Design Consultant, but the Design Consultant has not verified that the product offering by

manufacturer meets to all specification and project requirements. Contractor shall adhere to submittal review process for final approval on products.

B. Conveniently Accessible – Capable of being reached from the floor or via the use of a 6 to 12 foot tall step ladder without crawling or climbing over or under obstacles such as piping, duct work, motors, transformers, pumps, etc.

C. Firestopping System – Firestopping products that have been specifically tested and rated by a Nationally Recognized Testing Laboratory (NRTL), such as UL, to provide the required flame (F), fire and temperature (T), air and smoke (L), and water (W) containment for a given partition/penetration.

D. Ground or Grounding – A conducting connection, whether intentional or accidental, between an electrical circuit (e.g. telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.

E. IMC – Intermediate Metal Conduit

F. Plenum – A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

G. Plenum-rated – A product that is listed by a NRTL as being suitable for installation into a plenum space.

H. RMC – Rigid Metal Conduit

I. Surface Metal Raceway – A metallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.

J. Surface Nonmetallic Raceway – A nonmetallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.

K. UL – Underwriters Laboratory

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping, ducts, and other systems installed at required slopes and/or elevations.
4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.

5. Adjust location of conduits, terminal blocks, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.

    a. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
    b. Provide offsets, transitions, and changes in direction of conduit* as required to maintain proper headroom and pitch on sloping lines. *Refer to Part 3 of this section for stringent conduit bend requirements.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for Division 28 equipment that are behind finished surfaces or otherwise concealed.

D. Coordinate testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS AND MATERIALS

2.1 PATHWAYS FOR ELECTRONIC SECURITY SYSTEMS

A. General

1. Category 6 and fiber cabling and pathways between Equipment Rooms (shared Communications Rooms) and devices are by Division 27.
2. All other cabling serving Electronic Security System devices within the footprint of the building shall meet the following requirements (from device to Equipment Room):

    a. For areas above accessible ceilings, supported via J-hooks every 48”-60” back to nearest cable tray or serving Equipment Room. For inaccessible ceilings or ceilings exposed to structure, continue routing cable within conduit.

3. Division 28 “Electronic Security Systems” Contractor is to indicate proposed pathway types/supports and routing on Division 281000 Shop Drawings.

B. Conduit

1. The following manufacturers are Conditionally Approved.

    a. Metal Conduit and Tubing

        1) AFC Cable Systems www.afcweb.com
        2) Anaconda/Anamet www.anacondasealtite.com
        3) AtKore/Allied Tube & Conduit www.atkore.com
        4) Electri-Flex Co. www.electriflex.com

5) Emerson/O-Z Gedney www.emersonindustrial.com
6) Sapa/Indalex www.sapagroup.com
7) Southwire/Alflex www.southwire.com
8) Wheatland Tube Co. www.wheatland.com
9) Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

b. Nonmetallic Raceway and Tubing

1) AFC Cable Systems www.afcweb.com
2) Anaconda/Anamet www.anacondasealtite.com
3) AtKore/Allied Tube & Conduit www.atkore.com
4) Cantex Inc. www.cantexinc.com
5) CertainTeed www.certainteed.com
6) Condux www.condux.com
7) Duraline www.duraline.com
8) Electri-Flex Co. www.electriflex.com
9) Superflex Ltd. www.superflex.com
10) Thomas & Betts/Carlon www.tnb.com

c. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

2. Specifications

a. Refer to Electrical Division 26 for specific product and material information.

1) Sizes, methods, and more stringent requirements shall be adhered to when specified in this Division.

b. Conduits routed within the building as connection to outside devices (exterior to the footprint of the building) shall be rigid metal (RMC) or intermediate metal conduit (IMC) at the point it enters the building, emerges from an exterior wall or ground floor slab to the final Equipment Room termination/transition point.

1) If services enter a room or space such as a mechanical room, electrical room or other intermediate room due to convenience or proximity to the exterior and adequate space has not been provided within 50 feet for the equipment needed for transitioning these and future cables/services to an appropriately rated indoor cable then those conduits shall be continued uninterrupted (except for necessary pull boxes) to the final connection point or location where the transition point has been designated.

c. For interior devices (and devices on the face of exterior walls) Electrical metallic tubing (EMT) with compression connectors shall be used where concealed in walls, above ceiling, and exposed or concealed in equipment rooms.
d. Unless specifically identified on the Security drawings, flexible conduit shall not be used.
e. Conduits shall be dedicated to specific sub-systems (i.e. video cabling shall not be installed in any other sub-system conduit, such as access control, intrusion detection, fire alarm, etc.).
f. Provide conduit as indicated on the Drawings or required by this Specification.

1) Minimum conduit size for all Category 6 cabling shall be: ¾" inch for interior locations and 1" for exterior locations (such as devices at light poles and gates).
2) Provide a polypropylene or monofilament plastic line with not less than 200-lb tensile strength in each conduit.
3) Permanently mark or tag each conduit at the source and inside each pull box, identifying it based on specific subsystem (Access Control, Intrusion Detection, etc) and far-end destination. Each conduit that is stubbed into the ceiling space from an outlet box shall be permanently marked or tagged; refer to Labeling requirements in Section 3 – Execution.

C. Outlet Boxes

1. The following manufacturers are Conditionally Approved, unless otherwise noted.
   a. Emerson/Appleton
   b. Hubbell/RACO
   c. Randl Industries
   d. Thomas & Betts/Steel City
   e. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
2. Specifications
   a. Boxes shall either be square or rectangular, as noted on the drawings. Dimensions indicate minimum size.
   b. For masonry (CMU) walls, backbox shall be 3-1/2 inches deep. Manufacturer shall be:
      1) Single gang – RACO 695R, no substitutes
      2) Double gang – RACO 696R, no substitutes
   c. For stud walls, backbox shall be 2-3/4 inches deep. Manufacturer shall be:
      1) Single gang – RACO 560 series, or equivalent from Conditionally approved manufacturer.
   d. Telecommunications Boxes for Security – for camera outlets shown on TY drawings:
      1) For stud walls: dual-gang outlet box shall be a minimum size of 4-11/16 inches width by 4-11/16 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension as needed for flush mounting. Depth shall match that of wall gypsum board(s).
         a) Double gang – RACO 258/259 (Coordinate knock-out size with conduit size indicated on drawings), RANDL T-55017 or equivalent with appropriate
      2) For ceilings (flush or above accessible ceiling): plenum-rated, dual-gang outlet box shall be a minimum size of 4 inches width by 4 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension ring as needed for flush mounting. Depth shall match thickness of gypsum ceiling board(s) or accessible ceiling panel (if applicable).

a) Double gang – RACO 239 or equivalent, with ceiling grid framing where installed in accessible ceiling.

e. Junction Box – in accessible ceiling space above access controlled doors

1) Minimum Size 6" x 6" x 4" deep, or as noted on drawings/details, with hinged cover
2) NEMA 1 rating
3) Manufacturer shall be Hoffman A6N64 (or larger) or equivalent from Conditionally approved manufacturer.

f. Pull Boxes - for interior use only, mounted in Conveniently Accessible Locations.

1) Specifications

a) NEMA 1
b) Refer to Execution section for sizing requirements.

2) The following manufacturers are Conditionally Approved.

a) Hoffman
b) NEMA Enclosures
c) Wiegmann
d) Or Equivalent

2.2 GROUNDING AND BONDING

A. Refer to drawings and Division 28 Section "Equipment Room Fittings for Electronic Security" for exact grounding and bonding requirements.

2.3 FIRESTOPPING SYSTEMS

A. General

1. The following manufacturers are Conditionally Approved.

a. 3M
b. Hilti
c. Specified Technologies, Inc

2. Division 28 "Electronic Security Systems" Contractor is to indicate proposed Firestopping locations that correspond to their proposed pathway and cable routing on Division 281000 Shop Drawings.
3. Refer to Architecture / Life Safety plans for locations of fire- and smoke-rated walls.

B. Fire-Rated Pathway Device – for sleeves through a single penetration (wall or floor)

1. Specifications

a. Minimum performance requirements: Shall meet testing requirements of ASTM E-814 or U.L. 1479; Shall be installed in accordance with the NRTL. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer's instructions.

b. Shall meet or exceed the ratings of the wall or floor that it penetrates.
c. Shall be a prefabricated and zero-maintenance solution which requires no action to activate the fire and smoke protective characteristics of the device.
d. Allows the installation and removal of cables without the need to remove or add any materials.
e. Used to seal penetrations of cables through fire rated partitions

2. Manufacturer shall be:

a. EZ-Path family of products by Specified Technologies Inc.
b. SpeedSleeve series of products by Hilti
c. Or approved equivalent

C. Firestopping for Backboxes in Fire-Rated Walls

1. Specifications

a. Used to seal backboxes in fire rated partitions.
b. Minimum performance requirements: Shall meet UL testing requirements of UL 263 and classified as Wall Opening Protective Material (QCSN or CLIV); Shall be installed in accordance with the NRTL. Shall meet or exceed the ratings of the wall or floor that it is located in.
c. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer's instructions.

2. Manufacturer shall be:

a. Specified Technologies Inc., SpecSeal Power Shield
b. Or approved equivalent

D. Firestopping for Thru-Wall (or Floor) Conduit Penetrations and Other Applications

1. For fire-rated penetrations where the pathway extends beyond a single fire-rated partition, and other required firestopping applications not previously addressed in this specification.
2. Specifications:

a. Shall be UL listed for the specific application; Shall meet or exceed the ratings of the wall or floor that it penetrates.

3. Manufacturer shall be:

a. Specified Technologies Inc.
b. Or approved equivalent

2.4 ACCESS PANELS

A. The following manufacturers are Conditionally Approved.

1. Activar/J.L. Industries www.activarcpg.com
2. Acudor Products www.acudor.com
3. Alfab/Barco www.alfabinc.com
4. Elmdor Products www.elmdorproducts.com

5. Karp Associates, Inc. www.karpinc.com
6. Milcor www.commercialproductsgroup.com
7. Nystrom Building Products www.nystrom.com
8. Williams Brothers www.wbdoors.com
9. Wind-lock www.wind-lock.com
10. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

B. Specifications:

1. To be utilized for access to a Pull Box that is installed above an inaccessible ceiling (where a Pull Box is required to keep the quantity of bends in conduit to 180 degrees or less between pull points).
2. Steel Access Panels and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation.
3. Joints and seams: continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
4. Frames: 16-gauge steel, with a 1 inch (25.4 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling:
    a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
    b. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
    c. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
5. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
6. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

C. Locking Devices:

1. Wherever these are in a publicly accessible space and are less than 9' AFF, provide a lock.
2. Lock shall be 5-pin or 5-disc type cylinder locks, individually keyed.
3. Provide 2 keys.

D. *Indicate proposed size and locations on pre-construction shop drawings. No access panels shall be installed without Architect and Design Consultant approval. *

2.5 FASTENINGS

A. Except in equipment rooms, all exposed securing screws shall be stainless steel, center pin torx security screws. Security Fasteners: A maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.

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

1. Holo-Krome; a Danaher Corporation.
2. Safety Socket Screw Corporation.
3. Tamper-Pruf Screws, Inc.
4. Textron Inc.

2.6 IDENTIFICATION FOR COMMON WORK FOR ELECTRONIC SECURITY SYSTEMS

A. Labels

1. The following manufacturers are Conditionally Approved for generic labeling requirements for conduits, pullboxes, and equipment racks.

a.	Brady	www.bradycorp.com
b.	Brother	www.brother-usa.com
c.	Dymo	www.dymo.com
d.	HellermannTyton	www.hellermanntyton.com
e.	Panduit	www.panduit.com

f. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

2. Specifications:

a. Refer to additional requirements in Part 3 – Execution.
b. Refer to individual sections for additional identification requirements for specific work.

PART 3 - EXECUTION

3.1 PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

A. General

1. Refer to Electrical Division 26 for specific installation requirements.

a. Sizes, methods, and more stringent requirements shall be adhered to when specified in this Division.

2. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
3. All supports shall be specifically designed to support the required cable weight and volume. Field manufactured supports will not be accepted.
4. Install a pull cord in each pathway (empty or not) for installation of new wires or cables. Use polypropylene or monofilament plastic line with not less than 200 lb. (90.7 kg) tensile strength. Leave at least 12 inches (304.8 mm) of slack at each end of pull cord.
5. Unless otherwise noted, pathway routing shown on the Drawings is illustrative only and meant to indicate the general configuration of the work. Install pathways so that

adequate clearances and offsets between pathways and other trades are provided. Coordinate all pathways with other trades prior to installation.

6. All pathways shall include empty space for a minimum of 25% growth beyond initial installation of cabling.
7. Cables shall be rigidly supported by cable pathways as indicated on the drawings. Cables shall be physically supported at intervals not to exceed 5 feet (1.52 m).
8. Store and keep dry all products in original container in a climate controlled environment until installation is to occur
9. Install all pathways:
    a. So that cables can be pulled in accordance with referenced standards and guidelines.
    b. So that cables can be pulled without damage to conductors, shield, armor, or jacket.
    c. So that cables are not forced or allowed to exceed minimum allowed bend radius by manufacturer or referenced standards and guidelines.
    d. So that the maximum allowable pulling tension is not exceeded.
    e. To meet the requirements of the structure and the requirements of all other Work on the Project
    f. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.
    g. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Architect.
    h. Parallel or perpendicular to building lines or column lines.
    i. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
10. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or other methods shall not be used to attach cables to cable supports.
11. Provide adequate pathways so that cabling is not forced to attach, be supported, or use other pathways not specifically designed and provided for. Any deviation from this will not be accepted.
    a. At no point shall cables contact, be supported by, or attach to other trades equipment or supports.
    b. At no point shall cables contact, be supported by, or attach to building structures or supports.
12. Provide appropriately sized sleeves where cables (supported by J-hooks) are required to pass through non-rated full-height partitions. Where allowed, sleeves shall extend a minimum of 3 inches beyond the partition surface on both sides and shall be rigidly supported to support the weight of cables. Sleeves shall be sized so that no more than 40% of the cross-sectional area is utilized by the cabling to be installed.
13. Suspended cables shall be installed with at least 3 inches of clear vertical space above the ceiling tiles and support channels (T-bars).

14. Waterproofing

    a. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
    b. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.

15. Cutting and Patching

    a. Where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc. using skilled tradespeople of the trades required at no additional cost to the Owner.
    b. Do not cut, channel, chase or drill masonry, tile, etc., unless permission from the Architect is obtained. If permission is granted, perform this work in a manner acceptable to the Architect.
    c. Patch around all openings to match adjacent construction.
    d. Where conduit or equipment is mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
    e. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.
    f. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

16. Mounting Heights

    a. Mounting heights for equipment and devices requiring operational access shall conform to ADA requirements.
    b. Wall mounted devices requiring operational access shall be mounted a minimum of 15 inches above finished floor to bottom of device and a maximum of 48 inches above finished floor to top of device.
    c. Mounting heights shall be from floor to center of device, unless otherwise noted. Verify exact locations and mounting heights with the Architect before installation.
    d. Typical mounting heights shall match nearest adjacent typical electrical outlet mounting height UON or as directed by the Architect.

17. Painting

    a. Refer to Division 9 Section “Painting” for painting requirements.

b. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under Division 9 of the Specifications; colors shall be as selected by the Architect.

   1) If painting happens after cabling has been installed, cabling shall be masked off or otherwise protected so that cables are not painted. Paint on cables degrades the cable over time. PAINTED CABLES SHALL BE REPLACED with no additional cost to the owner.

c. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.
d. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.
e. Where factory finishes are provided and no additional field painting is specified, touch-up or refinish, as required by, and to the acceptance of, the Architect and Design Consultant, marred or damaged surfaces to leave a smooth, uniform finish. If, in the opinion of the Architect or Design Consultant, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.
f. Provide touch-up paint as required by Specification Sections in this Division.

18. Fastenings

a. Fasten equipment to building structure in accordance with the best industry practice.
b. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.
c. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   1) To Wood: Fasten with lag screws or through bolts.
   2) To New Concrete: Bolt to concrete inserts.
   3) To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4) To Existing Concrete: Expansion anchor fasteners.
   5) To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
   6) To Light Steel: Sheet metal screws.
   7) Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

d. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Architect and conform to the following as a minimum:

1) Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.

e. For items, which are shown as being ceiling mounted at locations were fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

f. Areas identified as noise critical spaces shall have all penetrations sealed to minimize sound transmission between adjacent spaces.

B. Access to pathways and associated equipment

1. Locate all pull boxes, junction boxes and fire-rated pathway devices to provide easy access for operation, service inspection and maintenance.
2. Provide an access door/panel where equipment or devices are located above inaccessible ceilings. Where access doors/panels are necessary but not shown on the plans, coordinate type and location with Architect and Design Consultant through an RFI.
3. Maintain all code required clearances and clearances required by manufacturers.

C. Cable Distribution

1. For low-voltage cabling (that provides power at 70v or less), refer to section 2.1 above.

D. Conduits

1. Conduit shall be of the appropriate type required by code and as required by Electrical Division 26.
2. Adequate access shall be available where cables enter conduits
3. Bond and ground all metallic conduits and boxes in accordance with national or local requirements (ANSI STD-607 – "Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications).
4. Install conduits in the most direct route possible, running parallel to building lines
5. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
6. Conduits which enter Telecommunications or Security/Equipment rooms shall extend 3 inches AFF or through the wall.
7. Flexible conduits may only be used where specifically allowed by these contract documents.

   a. Where indicated, flexible conduit sections shall be less than 20 feet in length.

8. No continuous section of a conduit may exceed 100 feet without a Pull Box.
9. No more than (2) 90° bends, or equivalent will be allowed between Pull Boxes.

a. Each and any offset shall be considered a 90° bend.
b. A Pull Box is required wherever a reverse bend is installed.

10. The minimum bend radius for conduits is:
    a. (6) times the inside diameter for 2 inches conduits or less.
    b. (10) times the inside diameter for conduits greater than 2 inches.
11. Conduits shall contain no electrical condulets (also known as LBs).
12. Underground Conduit Requirements
    a. Cabling and pathways serving devices exterior to the building, such as emergency phones/towers and security cameras.
    b. Requirements
        1) Refer to applicable details on drawings for illustrative requirements.
        2) Route all underground conduit so there is no more than (3) 90 degree bends, including stub-up bend at communications room/equipment cabinet.
            a) For underground conduit serving outlets/boxes outside the footprint of the building that require more than (3) 90 degree bends, provide appropriately sized handhole(s). Coordinate location with Architect and Owner, indicate proposed location(s) on shop drawings, and include product information in pre-construction submittals. In general, handholes are NOT to be in roadways, parking lots, sidewalks, or any location that may be subject to vehicular traffic.
            b) These underground conduits shall stub directly into the serving Communications Room/Equipment Room. If not, extend cabling within the building in IMC or RMC to the serving Equipment Room.
        3) Approved conduit types:
            a) When routed below slab-on-grade or outside the footprint of the building:
                i) Horizontal conduit shall be RMC or Schedule 40 PVC a minimum of 12” below grade. If PVC is installed, also install tracer wire.
                ii) All vertical and horizontal bends and areas subject to vehicular traffic (loads) such as parking lots and roadways shall be RMC or concrete-encased PVC.

E. Outlet boxes
    1. No outlet boxes shall be located back-to-back in a wall cavity.
        a. Where possible offset to next stud cavity, with a minimum of 6 inch separation.
    2. Outlet boxes located in fire-rated walls are to have the appropriate firestopping for backboxes. These locations are to be identified on shop drawings.
    3. Where cabling enters a backbox directly (not via conduit), provide black rubber grommet on knockout.

F. Pull Boxes

1. Pull Boxes shall be placed in Conveniently Accessible locations.
2. Coordinate the location and installation of all Pull Boxes to ensure adequate access is provided.
3. Pull Boxes above an accessible ceiling shall:
    a. Be aligned directly over the ceiling grid to allow access
    b. Be installed with a minimum of 3 inches (76.2 mm) clearance to ceiling grid and tiles
4. No directional changes shall be allowed in Pull Boxes. Conduit shall continue in the same direction as it enters and then change direction via an appropriately sized bend in the conduit.
5. Size Pull Boxes according to the following chart:

TABLE 1: Pull Box Sizing

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit (of same size)
¾" or smaller	4"	4"	2-1/8"	Not applicable
1"	4"	16"	3"	2"
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

3.2 LABELING

A. Labeling Installation

1. Labels are to be secured by adhesive. They shall have a type of adhesive that is appropriate for the surface upon which the label is to be installed. The mounting surface shall be free of dust, dirt, oil, etc. that would impede the adhesion of the labels.

B. Labeling Requirements

1. Labels are to be installed on or for:
    a. All firestopping systems. For wall and floor penetrations, label on both sides. See Firestopping later in this section.
    b. All pathways (e.g., conduit etc.) installed under this work.
        1) Label all conduit with "SECURITY". Conduit labels shall utilize text readable from a standing position on the finished floor. Conduit sleeves which pass through a single wall or floor need not be labeled.
            a) For wall stub-up locations, label overhead only.
            b) For conduits greater than 10', label both ends of conduit with far end location and Room/Number.

i) Example – "Security to Panel 1 in Equipment Room 127".

c) For conduits that stub directly up or into an Equipment Room, label both ends of conduit.

i) Example: under slab/ground conduit from Equipment Room 127 to Camera #13 attached to an exterior light pole shall be labeled as follows:

(1) Conduit stub-up location in Equipment Room 127 – "Security to Camera #13".
(2) In the light pole/junction box, immediately adjacent to serving conduit – "Security to Equipment Room 127".

2) All pullboxes and junction boxes for Security shall be labeled "SECURITY PULLBOX" on the cover, such that the text is of sufficient size to be readable from a standing position on the finished floor.

a) Conduits entering and exiting all pullboxes and junction boxes shall be labeled with their destination/room number – i.e. "To Security Camera #17 in Room 114".

c. In general, the label is to be provided and installed by whomever installed the item that is being labeled.
d. Refer to individual Division 28 sections and to the drawings for additional information on labeling requirements.

3.3 FIRESTOPPING

A. General

1. Provide fire resistant materials of a type and composition necessary to restore fire ratings to all wall, floor, or ceiling penetrations, including membrane penetrations. All materials shall be classified or listed as a complete system by UL (or an approved NRTL by the Design Consultant and AHJ) and meet NEC and local codes. The use of partial systems or components of systems is not allowed unless specifically identified in the documents.
2. All penetrations through fire rated floors and walls shall be sealed to prevent the passage of smoke, flame, toxic gas, or water through the penetration before, during or after a fire. The fire rating (F and T) of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by referenced building codes.

a. Assume all floors are fire-rated, unless otherwise noted.
b. Also install fire stops at any other locations indicated in the Specifications or Drawings.

3. Provide a label on both sides of fire rated assembly at all fire stop locations indicating:

a. Fire stop Manufacturer
b. Installer and company

c. Date installed
d. UL system number with all relevant ratings indicated

4. Include labels in each Equipment Room in which one or more fire-rated walls is installed. Provide a 2" block letter stencil label on the inside of the room to indicate rating for each barrier.
5. Provide systems as identified on the drawings and specified herein. At locations where the cabling routing encounters a fire-rated barrier provide an adequately sized fire stop device for the quantities and types for all cables to be installed plus 25% growth.

B. Penetration Sealant – Conduits

1. Provide listed system to seal around openings between wall, floor, or partition around conduits in accordance with system listing and manufacturer's instructions.

C. Penetration Sealant – Voids, Cavities, and Openings

1. Install fire stop materials in the framed openings through fire rated partitions per the Architect's drawings and in accordance with the NRTL listed system instructions.
2. Fire stop all voids, cavities, and openings left by the removal of cabling, conduits, conduit sleeves, cable trays or other equipment related to the communications systems not to be reused.
3. Install the fire stop system in accordance with the manufacturer's instructions and local codes.

D. Fire-Rated Pathway Device

1. Provide fire-rated pathway device anywhere cables are required to pass through fire-rated walls, floors, or partitions.
2. Devices shall be installed in locations where required by the Contract Drawings, arranged individually or appropriately ganged.
3. Install the devices in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
4. Apply the factory supplied gasketing material (where required) prior to the installation of the wall plates.
5. Secure wall plates (where required) to devices per the equipment manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. As part of a complete and functioning Electronic Security System and associated infrastructure, provide conductors and cables of appropriate type. This section includes:

1. Low-voltage Control and Power Cables
2. Coaxial Cabling

B. Conductor and cable requirements are unique to each manufacturer equipment / device. Unless otherwise noted, exact conductor and cable types are to be coordinated by the ESC to meet the requirements of the Electronic Security manufacturer

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work under this section shall follow Division 28 Sections “General Electronic Safety and Security Requirements” and “Electronic Security Systems”.

C. Conductors and cables as specified in this section shall be supported and installed into pathways, backboxes, firestopping, and other general/common work per Division 28 Section “Common Work Results for Electronic Security Systems”.

D. Refer to Division 27 Specifications for all Category 6 and Fiber Optic Cable requirements.

E. Refer to Division 28 Section “Equipment Room Fittings for Electronic Security” for grounding and bonding requirements.

F. Refer to individual Electronic Security System sections for additional conductor and cabling requirements.

1.3 SUBMITTALS

A. Follow the requirements for submittals in Division 28 Sections “General Electronic Safety and Security Requirements” and “Electronic Security Systems”.

B. The following additional requirements at due at the following submittal phases:

1. Pre-Construction Submittal
    a. Cut sheets shall contain the following information for each of the cables specified.
        1) Manufacturers name and logo
        2) Cable outside diameter

3) Number of conductors/strands in each cable and binder group
4) Gauge or strand thickness
5) Cable jacket material and rating (i.e. Plenum, Riser, wet-rated, etc.)
6) Maximum pulling tension
7) Jacket/Sheath color
8) Individual conductor or strand insulation colors (if applicable)
9) Minimum bend radius

a) During installation and post installation if it differs.

b. Shop Drawings

1) Cable types required by this Section are to be identified on Shop Drawings for the following Electronic Security sub-systems: (separate 281010 Shop Drawings for this section are not needed)

a) Access Control
b) Video Surveillance

2) On the Shop Drawings for those Electronic Security sub-systems, show the proposed routing of all conductors and cables and the means of support:

a) Cable Tray
b) Conduit (solid line)
c) J-hooks every 48”-60” (dashed line), if allowed by Contract Documents

3) On the Shop Drawings for those Electronic Security sub-systems, include details showing the proposed termination and labeling (ID) scheme at each device and panel for each conductor/cable.

2. Preliminary Project Completion Submittal

a. Follow all requirements as specified in Division 28 Section “Electronic Security Systems”.
b. Update the approved shop drawings with any changes in cable routing and submit as part of Preliminary Record Drawings per Division 28 Section “Electronic Security Systems”.
c. Test Results

1) Include conductor/strand test as part of the Functional Test Reports for each Electronic Security sub-system.

d. Cable ID spreadsheet, saved in PDF and Microsoft Excel file formats, which shall include the following for each cable installed under this section:

1) Electronic Security Sub-System
2) Device Type
3) Device Identifier
4) Device Room Number (if not part of Device Identifier)
5) Headend Panel Identifier
6) Headend Panel Room Number (if not part of Headend Panel Identifier)
7) Cable Identifier

TABLE 1: CABLE IDENTIFICATION SPREADSHEET

Sub-System	Device Type/ID	Device Rm	Headend ID	Headend Rm	Cable ID
Access Control	Card Reader 01	Vestibule 101	ACP-01	IDF 114	AC-CR01-ACP01

3. Final Project Completion Submittal
    a. Follow all requirements as specified in Division 28 Section "Electronic Security Systems".
    b. Incorporate any changes from punch list items.
    c. Include updated Cable ID spreadsheet.

1.4 DEFINITIONS

A. Damp Location – as defined by the NEC, locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. For the purposes of Work under this division, assume all Damp Locations require wet-rated cabling.

B. Point of Entrance (Building Entrance) – as defined by the NEC, the point within a building where the security cabling routed through a Wet Location emerges from an external wall, a concrete floor slab, or IMC/RMC.

C. Qualified Electrician – one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved; regarding to this project, a Qualified Electrician is also licensed in the jurisdiction of the project to install electrical equipment (i.e. Journeyman or Master Electrician License).

D. Wet Location - as defined in the NEC, installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL REQUIREMENTS

A. Conductors and cables shall meet the following the requirements:
    1. UL Listed and Approved for the intended application
        a. Where areas above accessible ceilings are serving as plenum (air) return, and conductors/cabling is not installed in conduit from device to serving panel or Equipment Room, the conductors/cabling shall be Plenum (CMP) rated.

b. Where conductors/cabling are installed in conduit from device to serving panel or Equipment Room, the conductors/cabling shall be Riser (CMR), or Plenum rated.
c. Where conductors are/cabling are routed through a Wet Location,

2. Cable type and conductor size/quantity shall be as recommended or required by the device/equipment manufacturer. Where the Contract Documents differ from manufacturer recommendations or requirements, notify the Architect requesting clarification.
3. Conductor sizes, if shown, are minimum. Were approved by the Design Consultant and at no extra cost to the Owner, larger conductor sizes may be installed at Contractor's option to utilize stock sizes, provided raceway sizes are increased to correspond with fill ratio requirements defined the NEC.
4. Conductors and cables shall be shielded.
    a. Submit RFI for any manufacturer equipment that recommends non-shielded cable.

B. The following Manufacturers are conditionally approved:

1. Belden
2. Draka
3. General Cable
4. Tappan
5. West Penn Wire

2.2 LOW-VOLTAGE CONTROL AND POWER CABLES

A. For 10 AWG through 24 AWG, and single conductors through 24-pair applications, as needed per project.

B. General requirements:

1. Shielded (overall shield)
2. Stranded and insulated conductors
3. PVC jacket
4. Size conductors per manufacturer recommendations and power/voltage drop based on installed cable length.

C. Manufacturer shall be:

1. Submit product cutsheets concurrently with Shop Drawings, identifying cable type, manufacturer, and part number on the Riser Diagram.
    a. Call out non-plenum (Riser-rated and Wet-rated) cables (where specifically allowed)

PART 3 - EXECUTION

3.1 CABLE INSTALLATION

A. Pre-Installation

1. Following the Notice to Proceed, the ESC's Quality Control Specialist or Project Manager (as defined in Division 28 section "Electronic Security Systems") shall coordinate with the Contractor or Sub-Contractor responsible for Division 28 "Common Work Results for Electronic Security Systems" (i.e. the conduits, backboxes, etc), if Contractors are different. Items of coordination shall include, but are not limited to:
    a. Conduit routing
    b. Conduit type for Building Entrance(s) – (see requirements below)
2. Conduit routing and type shall be indicated on at least one of the following Pre-Construction Shop Drawings:
    a. Division 28 "Common Work Results for Electronic Security"
    b. Division 28 "Electronic Security Systems"
3. After conduits/pathways are installed, but prior to cable installation, ESC's Quality Control Specialist and Project Manager shall inspect the Common Work (pathways and backboxes), paying special attention to:
    a. Conduit sizes and quantities matches Construction Documents and Project requirements
    b. Minimum bend radius
    c. Quantity of bends in conduit between pullboxes (180 degree change in direction, maximum)
    d. Building Entrance conduits are of appropriate type
    e. Any visible indication of improper or incomplete installation that may damage cable as it is installed.

B. General Requirements

1. Unless otherwise noted, all cables shall be routed through concealed conduit raceway.
    a. Conduits are not required above accessible (drop) ceilings; when not installed in conduit, cables shall be supported via j-hooks every 48 to 60 inches or less and at every change in direction. For areas where accessible ceiling is not available for pathway back to the Equipment Room, cables may be consolidated and routed in overhead conduit and conduit sleeves.
    b. Contractor is responsible for determining final cable and conduit routing; conduits may be consolidated in overhead pullboxes in accordance with Division 28 Section "Common Work Results for Electronic Security"; proposed (cable and) conduit routing and sizing shall be indicated on pre-construction shop drawings.

2. Install continuous conductors between outlets, devices and boxes without splices or taps. Do not pull connections into raceways. Leave at least 12 inches of conductor in backbox at each device location.
3. A Qualified Electrician shall install all control wire operating at 120V nominal and above. Control wiring operating at less than 120V (e.g., 12V and 24V) may be installed under the Division furnishing it.
4. All cables shall be plenum-rated, unless noted otherwise.
5. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or any other method shall not be used to attach cables to cable supports or to create cable bundles.
    a. Except when supported by ladder racking within each Telecommunications room, UON.
6. At the same time horizontal cables are pulled into a conduit also install a pull cord to facilitate future cable pulls along those. Use polypropylene or monofilament plastic line with not less than 200 lb. tensile strength. Leave at least 12 inches of slack at each end of pull cord.
7. Do not install kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable
8. Comply with all referenced standards and guidelines.
9. Cables shall be masked, covered, or otherwise protected from being painted or contacting any other substance that may degrade the performance or physical characteristics of the cable jacket or insulation over time.
10. Where space allows, all cables shall be provided with slack/service loops near each end of the cable, one in the accessible ceiling space or overhead J-box at the device and one at the Equipment Room. Each slack/service loop shall be:
11. A minimum of 3 feet (1 meter) in length, unless noted otherwise.
12. Prior to using any cable pulling lubricants provide the Design Consultant with written documentation from the cable manufacturer supporting the cable manufacturers' acceptance of its use in compliance with all required warranties as part of these contract documents. The use of non-water based lubricants shall be provided when pulling PVC jacketed and all cables not suitable for contact with water.
13. Install all cables and conductors in compliance with the requirements of Article 725 of the NEC, paying special attention to the following:
    a. Cables shall be installed in a neat and workmanlike manner.
    b. Separation requirements dependent upon installation location and proximity to other circuits.

C. Outside plant (OSP)/wet-rated cable installation: for cables placed in Wet Locations or as required by these construction documents. (I.e. all cables which extend beyond the footprint/envelope of the building or pathways leading to floor-boxes embedded in a ground floor slab)

1. No portion of outdoor only (unlisted) cables may be installed with the cable jacket exposed in any plenum or other air handling space nor shall they be allowed to transition between different levels of the building.

2. Rigid or intermediate metallic conduit shall be used to route outdoor (unlisted) cabling to the serving Equipment Room in accordance with the NEC; or a suitably-sized junction box shall be provided in an accessible location within 50' of where the outdoor cabling/conduit enters the building enters the building to allow the cable to transition from wet-rated to plenum-rated.
    a. Indicate this location on pre-construction shop drawings and final Record Drawings.
3. All cables which extend beyond the envelope/footprint of the building shall be installed with entrance protectors in accordance with Division 28 Section "Equipment Room Fittings for Electronic Security".

D. Security cables serving Elevators:
1. Provide cabling to the Elevator Demarcation Panel from the serving Access Control Panel.
2. For Card Readers located inside Elevator cabs, coordinate cable/conductor requirements with Elevator manufacturer/supplier/installer so that correct Elevator Traveling Cable(s) are installed.

3.2 CABLE IDENTIFICATION

A. Label all cabling with machine-printed labels according to the labeling scheme identified on the drawings or as described in Division 28 Section "Electronic Security Systems". Where the drawings and specifications are silent, submit RFI through appropriate channels requesting labeling scheme.
1. Shop drawings shall include floor plan and/or riser diagram that indicates proposed cable/device identification for each device.

B. Cables shall be labeled within 6" at each end.

C. All cable labels shall be thermal-transfer type and utilize self-adhesive labels. The following are approved manufacturers:
1. Brady, IDXPERT
2. Hellermann Tyton, Spirit 2100
3. Panduit LS9
4. Or equivalent

3.3 GENERAL CABLE TESTING

A. Pre-installation testing:
1. Visually inspect all cables, cable reels/boxes, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
2. Do not install any cable with less than the manufacturer's guaranteed number of serviceable conductors.

B. Post-installation testing (but prior to termination to devices/panels):

1. Conduct cable continuity testing upon completion of installation on each conductor.
2. Remove all defective cables from pathway systems. Do not abandon cables in place.

3.4 CABLE TERMINATIONS

A. Cable connections to device and security panel shall be soldered and heat-shrunk from jacket to jacket. Exposed conductors, even within an enclosure or backbox, are not allowed.

3.5 ACCEPTANCE

A. The ESC's Quality Control Specialist shall conduct an inspection after conductors and cabling have been installed to ensure compliance with the Construction Documents and project requirements.

B. Functional tests of the conductors and cables connected to equipment will be conducted by the ESC as part of Test Reports as specified in Division 28 "Electronic Security Systems" and individual Electronic Security sub-system Sections.

END OF SECTION

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. Provide a complete functioning Access Control System, and each element thereof, as specified, indicated, or reasonably inferred on the Drawings and in this Specification, including every article, device, or accessory (whether specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation, and utilities.

B. This Section consists of the control and monitoring of electro-mechanical barriers that limits physical access to authorized persons to openings (such as a gate or door) of a secured area (such as a property, facility, room, or cabinet). The system shall also monitor openings and initiate alarm if opening is forced open or left open for a set time.

C. The Access Control System shall consist of, but is not limited to, the following components:

1. System Software
    a. Integration with Video Surveillance VMS and cameras
2. Head-end Equipment
    a. Access Control Panels / Controllers
    b. Entrance Protectors
    c. Power Supplies & Integral Batteries
    d. Wall-Mounted Enclosures
3. Devices:
    a. Credential card readers and cards.
4. Interfaces and integrations with Elevator control and Video Surveillance, forming the Security Management System.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Pathways and other Common Work required by this section shall be provided per Division 28 section "Common Work Results for Electronic Security".

C. Cabling required by this section shall be provided per Division 28 section "Conductors and Cables for Electronic Security".

D. Phone and data connections required by this section shall be provided by Division 27 "Structured Cabling".

1. LAN and WAN connectivity required by this section shall be provided by Owner; provide patch cables (furnished and installed) at device end and at equipment rack between patch panels and owner's network switches. Refer to Division 28 Section "Network Requirements for Electronic Security" for coordination requirements with Owner.

E. For installation of ACS equipment in Equipment Rooms, refer to Division 28 Section "Equipment room Fittings for Electronic Security" for additional requirements.

F. For integration of the ACS with the Video Surveillance system and cameras, refer to Division 28 section "Video Surveillance" for additional requirements.

G. Some Electronic Security and Access Control devices required by this project are specified by other divisions.

1. Refer to the following sections and coordinate Division of Labor for each device with Prime Contractor prior to bid and installation:

a. Division 08 Section "Door Hardware" or "Commercial Door Hardware" for electric/electro-magnetic locks and strikes, door position switches, and request-to-exit motion detectors.
b. Division 11 Section "Parking Control Equipment" or "Parking Gates" for motorized site gates.

1.3 CODES, STANDARDS, AND GUIDELINES

A. Refer Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems" for a complete list of Codes, Standards, and Guidelines that Work under this section shall follow.

1.4 ABBREVIATIONS AND DEFINITIONS

A. ACS: Access Control System

B. API: Application Programming Interface

C. Central Station: A PC/Server with software designated as the main controlling PC of the security access 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. EMI: Electromagnetic Interference.

H. ESS: Electronic Security System.

I. Fail-Safe (Door): if power fails, the door is to unlock.

J. Fail-Secure (Door): if power fails, the door remains secure (locked).

K. Server: A PC in a network that stores the programs and data files shared by users.

L. 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.

M. I/O: Input/Output.

N. LAN: Local area network.

O. LDAP: Lightweight Directory Access Protocol.

P. LED: Light-emitting diode.

Q. Location: A Location on the network having a PC-to-Controller communications link. Where this term is presented with an initial capital letter, this definition applies.

R. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

S. PIN: Personal Identification Number.

T. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

U. RF: Radio frequency.

V. RS-232: A TIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

W. RS-485: A TIA standard for multipoint communications.

X. UPS: Uninterrupted power supply.

Y. VMS: Video Management System.

Z. WAN: Wide area network.

AA. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

BB. Workstation: A PC with software that is configured for specific limited access control system functions.

CC. WYSIWYG: (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications

1. The Access Control System shall be provided by the Electronic Security Contractor (ESC), as defined in Division 28 Section "Electronic Security Systems".

a. The ESC shall be a certified installed of the ACS vendor prior to bid; post-bid certification will not be accepted.

b. The ESC shall be pre-qualified; refer to Quality Assurance paragraph in Division 28 Section "Electronic Security Systems" for a list of pre-qualified contractors, and instructions for potential bidders wishing to become pre-qualified.

B. Personnel Qualifications

1. Refer to Division 28 Section "Electronic Security Systems" for personnel qualifications.

1.6 WARRANTIES

A. Refer to Division 28 Section "Electronic Security Systems" for warranty requirements.

1.7 COORDINATION

A. Access Control is an integrated system. Coordinate integration with installers and equipment of all other Electronic Security Systems.

B. Coordinate with Elevator manufacturer and installer for integration of card readers for:

1. Floor control – for card reader(s) internal to the elevator(s).

C. Within two weeks after the Notice to Proceed, schedule a meeting with the Owner's Security and/or Facility staff to confirm and coordinate additional sequence of operation and programming requirements of the Access Control System.

1. Document all direction from Owner in writing and distribute to the Design Consultant and Architect through the Prime Contractor.

1.8 SUBMITTALS

A. Follow the requirements for submittals in Division 28 Sections "General Electronic Safety & Security Requirements" and "Electronic Security Systems".

B. Pre-Bid Submittal - the following submittals are due before the questions deadline before Bid:

1. For all products for which a substitute is to be considered as an approved equivalent or acceptable substitution, provide submittals with sufficient detail for review by the Design Consultant. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information.

C. Pre-Construction Submittal

1. Refer to Division 28 Section "Electronic Security Systems" submittal requirements, with additional requirements as noted:

a. Product Cutsheets and Shop Drawings shall be submitted concurrently as part of the complete Electronic Security Systems pre-construction submittal. If the first submittal only includes Product Cutsheets, submittal will be returned "Not Reviewed".

b. Shop Drawings:

1) Submit plans, elevations, and details that include the following:

a) Indicate all system device locations on architectural floor plans, identified by number/ID. No other system(s) shall be included on these plans.

b) Enlarged Equipment Room wall elevation(s), indicating all wall-mounted pathways/cable management, wall-mounted enclosures, and all internal components of wall-mounted enclosures.

i) All components on these elevations shall be identified by part name, manufacturer, and model number.

c) Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.

d) Include a complete ACS one-line, block diagram.

i) Each far-end device shall be identified by number/ID and room number.

e) Include a statement of the system sequence of operation.

f) Backup Power-Supply (Battery) Capacity Calculations

2) Graphical map screen shots within the access control software that will be used to depict building and device locations/status.

D. Preliminary Project Completion Submittal

1. Refer to Division 28 Section "Electronic Security Systems" submittal requirements, with additional requirements as noted:

a. Test Results for the Access Control System. Refer to Project Close-Out Instruction in Part 3 of this section and Division 28 Section "Electronic Security Systems" for additional information and requirements.

E. Final Project Completion Submittal

1. Refer to Division 28 Section "Electronic Security Systems" submittal requirements, with additional requirements as noted:

a. Include scan of written documentation that Spare Parts / Physical Media were delivered to Owner at time of Owner Training.

2. Refer to Project Close-Out Instruction in Part 3 of this section and Division 28 Section "Electronic Security Systems" for additional information and requirements.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL

A. The Access Control System shall consist of Kantech hardware and software. The main user interface shall be the Kantech Entrapass Global Edition Software. A Kantech KT-NCC Gateway shall be the interface between the software and the door controllers. Door controllers shall be Kantech KT-400. Readers shall be Kantech "Smart Card" readers.

1. Stand-alone Access Control System

a. System shall consist of a PC-based Server, networked PC-based client workstation(s), and field-installed panels and devices, connected by an Owner-provided high-speed electronic data transmission network.

b. System Software

1) Provide applicable site license for the entirety of the Access Control System, to support the number of doors/devices on the plans plus 25% spare.

B. General Requirements

1. Unless otherwise designated, provide all of one type of equipment from one manufacturer.
2. Door Hardware Interface: Coordinate with Division 08 Sections that specify door and gate hardware required to be monitored or controlled by the ACS. 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 08 Sections to function with the controls and PC-based software and hardware in this Section.
3. Tamper Protection: Provide tamper switches on control units/enclosures, detection devices, and equipment cabinets. These shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or

disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

4. Network connecting the Central Workstation / Server, other workstations/enrollment stations, and field-installed controllers/panels shall be via a dedicated VLAN on the Owner-provided network.

2.2 ACCESS CONTROL SYSTEM SOFTWARE

A. Access Control System (ACS), Database Management, and Integration Platform

1. Software shall be Kantech Entrapass Global Edition.

B. Integration Requirements

1. Access Control system shall integrate with the following Electronic Security Systems

1) Master intercom stations shall be programmed to allow a button to release/unlock the door or gate adjacent to initiating intercom station.

b. Video Surveillance System

1) Workstation(s) shall be programmed to display live video from Video Surveillance cameras.
2) Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.
3) Display mouse-selectable icons representing each camera source, to select source to be displayed.

2. Access Control System Server / Central Workstation shall interface with the Owner's Active Directory database.

2.3 HEAD-END EQUIPMENT

A. Access Control Panels / Controllers and all required interfaces and accessories

1. Manufacturer shall be: **Kantech**

B. Entrance Protectors

1. General:

a. All cables which extend beyond the envelope/footprint of the building shall be installed with entrance protectors.

1) Card Readers/devices on the exterior face/wall of the building do not require protection.

2. Manufacturer shall be:

a. Ditek https://www.diteksurgeprotection.com/products/8-access-control-protection.html

1) Submit product cutsheets for appropriate devices required by the ACS of this project.

C. Power Supplies & Integral Batteries

1. Manufacturer shall be:

a. Altronix AL168600CB

D. Wall-Mounted Enclosures

1. Manufacturer shall be:

a. Same as Access Control board manufacturer.

2.4 WORKSTATION SOFTWARE, WORKSTATION(S), AND WORKSTATION ACCESSORIES

A. Workstation:

1. RHP i7 Z – <u>Submit for approval</u>

2.5 DEVICES:

A. Card Readers:

1. Manufacturers: **Kantech "Smart Card"**

B. Additional Components:

1. Kantech KT-MOD-INP16
2. Kantech KT-MOD-REL8

C. Credential Cards:

1. Requirements:

a. Compatible with Kantech "Smart Card" readers.

D. Interface with Elevators

1. Floor-Select Elevator Control

a. Elevator access control shall be integral to ACS.

1) System shall be capable of providing full elevator security and control through dedicated controllers without relying on the control-station host PC for elevator control decisions.
2) Access-control system shall enable and disable car calls on each floor.

a) Elevator door operations shall be such that a passenger's ingress and egress shall be restricted to the same door of the multi-door elevator for a given operation.

2. ACS shall record which call button is pressed, along with credential and time information.

a. System controller shall record elevator access data.

3. If needed, provide interface and/or accessories for connection of elevator card reader(s) to the ACS vendor's controller.

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. 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 Technical Drawings in electronic .dwg format.

B. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

C. After turn-over of Equipment Rooms by the Prime Contractor and Division 26 (Electrical) Contractor:

1. Verify the room is properly conditioned and all general construction dust and debris are removed. Verify that all electrical branch circuits provided for the ACS equipment are installed properly and active. Do not start up any powered ACS equipment until these requirements are verified.
    a. Refer to the following article for appropriate testing of branch circuits: http://www.ecmweb.com/content/ten-easy-steps-testing-branch-circuits
2. Do not commence installation of any ACS equipment within Equipment Rooms until entry door to that room is equipped with a lock and construction key. All Equipment Room doors shall be locked, even during construction, when no personnel are present and working in that room.

3.3 CABLING

A. Provide cabling for all access controlled doors and gates identified on the drawings and these specifications. Cable type and size shall meet all ACS vendor requirements for each type of device / connection. Coordinate the required cable specifications with Division 28 “Conductors and Cables for Electronic Security” contractor (if different from the ESC) prior to Bid.
    1. Utilize shielded cables/conductors unless ACS vendor specifically forbids the use of shielded cables/conductors.
    2. Use of a multi-conductor composite cable to access controlled doors is preferred, but not required, unless otherwise noted.
    3. Coordinate cable size and pathway requirements with Division 28 “Common Work Results for Electronic Security” contractor.

B. Comply with NECA 1, "Good Workmanship in Electrical Construction."

C. Cables and wiring shall be installed according to requirements in Division 28 Section "Conductors and Cables for Electronic Security."

D. Boxes and enclosures containing ACS 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 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.

E. Install end-of-line resistors at the field device location and not at the controller or panel location.

F. Ensure machine-printed, thermo-plastic labels are installed within 12” of each end of all cables.

G. Maintain insulation on all conductors to the final termination point within the enclosure; exposed copper conductors of any length are not allowed.

H. Provide a minimum of 6 inches of slack (service loop) at both ends of all cabling (at the device and within the ACS enclosure).

I. Obtain Category 6 Patch Cables from Division 27 “Structured Cabling” Contractor to connect all ACS equipment to the Owner’s network switch. Coordinate switch port assignment with Owner’s IT staff and install patch cords at the IT rack and within the ACS enclosure(s).

3.4 CABLE APPLICATION

A. Coordinate these requirements with Division 28 “Conductors and Cables for Electronic Security” contractor.

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. TIA 232-F Cabling (if required): Install at a maximum distance of 50 ft.

D. TIA 485-A Cabling (if required): Install at a maximum distance of 4000 ft.

E. 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 if maximum distance from controller to the reader is 250 ft., and install No. 20 AWG wire if maximum distance is 500 ft.
3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not allow voltage drop from power supply to lock to drop below manufacture’s stated minimum operating voltage.

G. Install minimum No. 14 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft.

3.5 GROUNDING AND BONDING

A. Properly ground/bond all ACS equipment in accordance with manufacturer’s instructions and per the drawings and Division 28 section “Equipment Room Fittings for Electronic Security”.

B. 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.

C. Bond shields and drain conductors to ground at only one point in each circuit.

D. Each entrance protector shall have its own ground/bond conductor to the TGB; do not bond to ACS enclosure.

E. Each ACS enclosure shall have its own ground/bond conductor to the TGB; do not daisy-chain enclosures together.

F. Minimum bonding/conductor size, in accordance with "Equipment Room Fittings for Electronic Security", is #6 AWG.

3.6 IDENTIFICATION & LABELING

A. Develop a system identification, testing, and management plan. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.

1. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
2. Enclosures shall be labeled with 2" by 4" engraved plastic label with 3/4" tall white characters. Attach label to enclosure door/cover with screws that do not extend more than 1/8" into the interior of the door/cover.

B. 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 device as shown.

C. At completion, Record Drawings and cable and equipment spreadsheets shall reflect as-built conditions.

3.7 SYSTEM SOFTWARE

A. Develop, program, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.8 HEAD-END EQUIPMENT

A. Furnish, install, and configure (program) all required controllers, interfaces, and accessories in the rooms identified on the plans.

B. All head-end equipment shall rack-mounted (where indicated) or within wall-mounted enclosures.

C. Monitoring Requirements:

1. The ACS shall act as a stand-alone monitoring system. Alarms shall be programmed to alert an on-site Monitoring Workstation.

2. The ACS shall integrate with the Division 28 Section "Intrusion Detection" system (IDS). Event alarms from within the ACS shall communicate alarm type and location to the IDS.
3. The ACS shall monitor end devices and report an alarm for the following events:
    a. Door Forced Alarm
    b. Door Held Open Too Long
    c. Panic / Duress Buttons
    d. Invalid, Lost, Stolen, Expired, or Terminated Badge
4. The ACS shall monitor power supply issues and report an alarm for the following events:
    a. Trouble Alarm: Normal power-off load assumed by battery.
    b. Trouble Alarm: Low battery.
    c. Alarm: Power off.

D. Central Server / Workstation

1. Ensure the operating system and ACS software for the central server / workstation provided under this section is up-to-date with latest versions and security patches.
2. Consolidate physical media (operating system and installation discs) and turn over to owner at time of Owner Training. Obtain written documentation from Owner currently and include copy with the Final Project Close-out Submittal.
3. Visit site 50 weeks after Substantial Completion (prior to the end of the 1 year warranty period) and update operating system and ACS software to the current version, including all security patches.

E. Controllers (Access Control Panels) and Interfaces

1. Primary communication from the Access Control Panels to the Central Server / Workstation shall be over the Owner's LAN/WAN.
    a. The ACP shall maintain a current copy of the credential database.
    b. In the event of a temporary LAN/WAN outage, the ACS shall still operate; when LAN/WAN connection is restored, the ACS shall automatically upload events/logs to the Central Server and download a current copy of the credential database.
2. The ACS and Access Control Panels shall be equipped with all required contact closures and interfaces to support the Monitoring Requirements paragraph above. Indicate these connections on Pre-Construction Shop Drawings and Record Drawings.
3. The ACS and Access Control Panels shall be equipped with all required inputs and interfaces to support the Elevator Control requirements from Part 2 of this Section. Provide all materials and programming necessary that restricts access to the Elevator Cab and/or certain floors to authorized credential holders.
    a. Coordinate with elevator installer for integration of in-cab card readers; the presentation of an authorized credential shall allow the elevator call button for approved/programmed floors to be enabled.

F. Wall-Mounted Enclosures

1. Install enclosures on plywood backboard, with bottom of enclosures parallel to floor. Bottom of bottom enclosure(s) shall be no lower than 30” above finished floor and top of top enclosure(s) shall be no higher than 74” above finished floor.
2. All enclosures, even within secured Equipment Rooms, shall be provided with locks. All locks shall be keyed the same. Turn over three keys to owner at time of Owner Training. Obtain written documentation from Owner currently and include copy with the Final Project Close-out Submittal.
3. Ensure label is installed on front face of each enclosure in accordance with Identification paragraph above.
4. Clearly identify/label the entry point / source of 120V power.
5. Ensure that any 120V wiring with the enclosure is installed in conduit; exposed 120v circuits are not allowed.
6. Layout of controllers and interfaces within enclosures shall be consistent from enclosure to enclosure and Equipment Room to Equipment Room.

3.9 WORKSTATION PCS

A. Ensure the operating system and ACS software for all workstation PCs provided under this section are up-to-date with latest versions and security patches.

B. Consolidate physical media (operating system and installation discs) and turn over to owner at time of Owner Training. Obtain written documentation from Owner and include copy with the final Project Close-out Submittal

C. Visit site 50 weeks after Substantial Completion (prior to the end of the 1 year warranty period) and update operating system and ACS software to the current version, including all security patches.

3.10 DEVICES

A. Electrified Door Hardware

1. Owner may want certain interior and external doors with electric/electro-magnetic locks to lock and unlock at certain day/time intervals, such that entry can be made through door without a valid credential during normal work hours. Coordinate these doors and schedule with Owner during initial coordination meeting with Owner immediately following Notice to Proceed.
2. In the event of a loss of power, doors shall Fail-Secure.
3. All egress doors shall allow individuals to freely exit the door without valid credential. Refer to Code Plans in the architectural set of drawings for egress door locations. Notify the Architect and Design Consultant immediately for any egress doors where free exit (without valid credential) conflicts with Contract Documents.

B. Card Readers

1. ADA actuator doors

a. Doors with ADA operators and managed by ACS shall be cabled, configured, and programmed to require valid credential before ADA push-button can actuate respective door opener.

3.11 FIELD QUALITY CONTROL

A. Refer to Part 3 of Division 28 section “Electronic Security Systems” for general installation and project close-out instructions.

B. Perform the following functional tests and inspections - and correct any issues - before requesting Final Acceptance Review by Design Consultant:

1. Follow Test Methods as required by ACS vendor.
2. Also follow Test Methods as listed in NFPA 731 Standard for the Installation of Electronic Premises Security Systems (2017), Table 10.4.3(a) and Table 10.4.3(b)
3. Test Reports:

a. Utilize Sample Record of Completion Report from NFPA 731 Standard for the Installation of Electronic Premises Security Systems (2017), Figure A.4.12.2.1(3)(a) as cover page of Access Control Test Reports.
b. Utilize Sample Access Control Report from NFPA 731 Standard for the Installation of Electronic Premises Security Systems (2017), Figure A.4.12.2.1(3)(c) to document testing of all ACS components.
c. Scan to PDF and combine these reports, arranged logically by serving Equipment Room and Device type/ID. Include this PDF as part of Preliminary Project Completion Submittal.

C. After Final Acceptance Review by Design Consultant, address/correct any issues, and re-test effected devices and components of the ACS.

1. Update Test Reports and include complete Test Reports as part of Final Project Completion Submittal.

3.12 STARTUP SERVICE

A. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

B. Enroll and prepare credentials for Owner's operators, management, and security personnel.

OWNER TRAINING / DEMONSTRATION

C. Owner's security and facility/maintenance personnel to adjust, operate, and maintain security access system. Assume a minimum of two 4 hour training sessions are required.

D. A training schedule shall be developed and submitted by the contractor and approved by the Owner a minimum of two weeks prior to the planned training.

E. 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.

END OF SECTION

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. Provide a complete functioning Video Surveillance System, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation, and utilities.

B. System Description:

1. This Video Surveillance system shall consist of IP cameras, the majority of which shall be Power-over-Ethernet, connected to the Electronic Security Network.
2. Other components include, but are not limited to, fiber to media converters, power supplies, surge protection devices, encoders, decoders, microphones, video servers, storage servers, client stations, video management software and associated equipment.
3. Network Video Recording shall be provided for recording and storing video and associated audio from all cameras at full resolution and 15 frames per second for a minimum of 30 days.
    a. Storage shall be in a RAID 5/6 configuration.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work under this section shall follow Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems".

C. Work under this section shall follow Division 28 Section "Common Work Results for Electronic Security Systems" for general pathway, firestopping, access panel, identification, and other requirements.

D. Other related documents include:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security".

1.3 ABBREVIATIONS AND DEFINITIONS

A. In addition to the Abbreviations and Definitions listed in Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems", products and installation shall meet the requirements of the following standards:

1. AC: Alternating Current

2. AGC: Automatic gain control.
3. B/W: Black and White
4. Bit Rate: B/s = Bytes per second, b/s = bits per second
5. CCD: Charge-coupled device
6. DC: Direct Current
7. DSP: Digital signal processing
8. FTP: File Transfer Protocol
9. GB: Gigabyte
10. IP: Internet Protocol
11. IRE: Institute of Radio Engineers. Units of measurement dividing the area from the bottom of the sync to the peak white level into 140 equal units. 140 IRE equals 1 Vp-p. The range of active video is 100 IRE.
12. IR light: Infrared light
13. JPEG. Joint Photographic Experts Group
14. KVM: Keyboard, Video, Mouse
15. LCD: Light-emitting diode
16. Lumen (lm). A unit for measuring intensity
17. Lux (lx): a unit for measuring illumination
18. MPEG: Moving picture experts group
19. NIC: Network Interface Card
20. NVR: Network Video Recorder
21. Pixel: Derived from picture element. Refers to CCD chip unit picture cell
22. POE: Power Over Ethernet
23. PTZ: Pan-Tilt-Zoom
24. RAM: Random Access Memory
25. RAID: Redundant arrays of independent disks
26. UXGA: Computer screen resolution offering 1600 X1200 Pixels
27. VGA: Video Graphics Array with resolution of 640 X 480 Pixels
28. VMS: Video Management Software
29. WAN: Wide Area Network
30. XGA: Computer screen resolution offering 1024 X 768 Pixels

1.4 QUALITY ASSURANCE

A. Contractor qualifications:

1. The ESC, or a qualified Video Surveillance Contractor acting as a sub-contractor to the ESC, shall have a minimum five (5) continuous years in the business of installing and integrating Video Surveillance Systems.
2. ESC or qualified sub-contractor shall be a certified installer by video surveillance manufacturers whose products shall be incorporated into this project. Post-award certification will not be accepted.
3. ESC or qualified sub-contractor shall maintain certification by the manufacturers thru the duration of the warrantee period.

B. Personnel qualifications

1. All equipment/device installation and programming shall be conducted by factory-certified technicians of the components being installed.

C. Warranty

1. At a minimum, the manufacturer(s) equipment shall be covered by a 1-year parts and labor warranty covered by the ESC starting from Substantial Completion.
2. Refer to Division 28 Section "Electronic Security Systems" for warranty and service call requirements.
    a. All Warranty Work shall be completed by factory-certified technician(s) of the component(s) being address.
3. Include, as part of Base Bid the associated cost to extend a parts and labor warranty for Video Surveillance components to 3 years.

1.5 SUBMITTALS

A. Refer to requirements in Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems".

B. Include the following additional items as part of the Video Surveillance submittals:

1. Phase two - "Bid"
    a. Unit Pricing:
        1) For each type of Security Camera – the addition/deletion cost of an individual Security Camera. Include all associated costs to furnish, install, terminate, test, and label, time, and fees to program the device into Video Surveillance software and the integrated Electronic Security System, and the required cabling and pathways to serve the device.
    b. Alternate pricing to extend maintenance and support and product warranty as in the Quality Assurance section above.
2. Phase three - "Pre-Construction"
    a. NVR storage calculations
    b. Network bandwidth calculations (per port, switch, and backbone connections)
    c. Hardware throughput calculations
    d. PoE budget and other power supply calculations

PART 2 - PRODUCTS

2.1 VIDEO MANAGEMENT SOFTWARE

A. The Video Management software shall be **Exacqvision Enterprise. Ensure integration with the Access Control software Entrapass Global.**

2.2 VIDEO MANAGEMENT SYSTEM SERVER(S)

A. The Video Management System shall be **Exacq A series sized to meet retention and performance requirements. Submit model for approval.**

B. Contractor shall supply all 19" rack support rails, mounting kits, and cable management modules to install Video Management server.

C. **Refer to retention requirements in Section 1.1 Summary for parameters to calculate minimum storage capacity of VMS based on camera quantities.**

D. The Performance requirements for the VMS Server are as follows:

1. Processor: Intel Quad Core Xeon 2.0 GHz or better
2. System RAM: minimum of 32 GB
3. Internal Storage Hard Drive(s): SATA-III 5400 RPM in RAID 5/6 configuration
    a. Storage calculations shall be included in proposal
4. Operating System shall be certified to work by the Video Management Software's manufacturer and be one of the following: Windows 10, Windows 10 IoT, or Windows Server 2012 or newer
5. VGA, DVI, HDMI, or custom KVM video output (match input of supplied KVM, see below)

E. External storage

1. External storage expansion may be necessary to meet the retention requirements. Manufacturer shall be **Exacq S series.**

F. KVM – Rack-mounted Keyboard, Video (Monitor), and Mouse

1. Provide a slide out, rack mounted monitor, keyboard, and mouse for direct access and management of each VMS server. The monitor and keyboard shall have access to all management features of the server, as well as the ability to view any of the connected cameras in the facility.
2. 1RU (1.75") height
3. 19" wide rack-mounting
4. Keyboard with integrated touchpad mouse
5. 15" (diagonal) minimum LCD
6. Manufacturer shall be:
    a. Dell 18.5in LED KVM & KMM, 1U (VGA input only)
    b. APC 17" Rack LCD Console - AP6717 (VGA input only)

2.3 SECURITY CAMERAS (IP)

A. Manufacturer and Model: **Refer to Camera Type Schedule on Security Legend sheet.**

2.4 MISCELLANEOUS EQUIPMENT FOR SECURITY CAMERAS

A. Camera-Supporting Equipment

1. Manufacturers:

a. Same as camera.

2. Accessories:

a. Axis T91B57 Pole Mount
b. Axis T91G61 Wall Mount

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 cameras and servers 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 CABLING

A. Coordinate these requirements with Division 28 “Conductors and Cables for Electronic Security” contractor and “Telecommunications Requirements for Electronic Security”.

B. Comply with NECA 1, "Good Workmanship in Electrical Construction."

C. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Security."

D. 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 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.

E. Obtain Category 5e/6 Patch Cables from Division 27 Contractor to connect Panels to the switch.

3.3 IDENTIFICATION / LABELING

A. Label the interior of each camera backbox with the Camera #.

B. Coordinate patch panel labeling for camera cabling with Division 27 Contractor to include Camera #.

C. Label both ends of all patch cables with Camera #.

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

3.4 GROUNDING

A. Refer to Division 28 Section "Equipment Room Fittings for Electronic Security" for entrance protection and additional grounding requirements.

B. Coordinate this work with Drawings.

3.5 CAMERA INSTALLATION

A. Install cameras level and plumb.

B. Refer to contract drawings for installation heights.

C. Install power supplies and other auxiliary components in Equipment Rooms, unless otherwise indicated.

D. Program camera titles and on-screen placement as coordinated with the Owner.

3.6 SYSTEM SOFTWARE

A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

B. The Contractor is responsible for the entire programming and setup of the system such that no additional programming is required. Programming shall include the setup of all available features of the software.

1. Prepare and install graphic maps.
2. Integrate with Access Control system.

C. Perform a full system back-up at completion of initial programming and deliver the configuration to the Owner.

D. Perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on any revisions to the Owner's operating requirements.

3.7 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.

3.8 PROJECT CLOSE-OUT INSTRUCTIONS

A. Follow all Project Close-Out requirements as detailed in Division 28 Section “Electronic Security System”.

B. Demonstration

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.
4. Conduct a minimum of four hours' training to Owner's employees. Provide tutorial on software and device components.

3.9 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 (re)adjust cameras and equipment as necessary. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

1. Tasks shall include, but are not limited to, the following:

a. Check cable connections.
b. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
c. Adjust all preset positions; consult Owner's personnel.
d. Provide a written report of adjustments.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 7 Section “Penetration Firestopping” for material and methods for firestopping systems.
2. Division 26 Section "Common Work Results for Electrical," for materials and methods for coordination, sleeves and common installation requirements.

1.02 DESCRIPTION OF WORK

A. This Section requires the Contractor to furnish all materials required to install the fire alarm system. The Contractor shall be responsible for installing, testing, and start-up of a complete functioning fire alarm system, and each element thereof, as specified or indicated on the Drawings or reasonably inferred, including every article, device or accessory (whether or not specifically called for by item) necessary to facilitate each system's function as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation and utilities.

B. Division 28 of the Specifications and Drawings numbered with prefixes FP generally describe these systems, but the scope of the Fire Alarm work includes all such work indicated in the Contract Documents: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Fire Suppression, Mechanical, Plumbing, Fire Alarm and Electrical Drawings and Specifications; and Addenda.

C. The Drawings have been prepared diagrammatically and are intended to convey the scope of work, indicating the general location and arrangement of the major equipment, devices, appliances, etc. without showing all the exact details as to elevations, circuits, routing, and other installation requirements. Use the Drawings as a guide when laying out the system and verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

D. The scope of work in this section includes:

1. Fire alarm control unit

2. Remote annunciator
3. Local Operating Console
4. Manual fire alarm pull stations
5. System smoke detectors
6. Single station smoke detectors
7. Heat detectors
8. Carbon monoxide detectors
9. Notification appliances
10. Sprinkler system waterflow and valve tamper alarms
11. Magnetic door holders
12. Elevator recall
13. Air handling unit shutdown
14. Battery stand-by power
15. Multi-channel one-way voice notification system
16. Digital alarm communicator transmitter (DACT)

1.03 QUALITY ASSURANCE

A. All work under this division shall be executed in a thorough professional manner by competent and experienced workmen licensed to perform the Work specified.

B. All work shall be installed in strict conformance with manufacturer's requirements and recommendations. Equipment and materials shall be installed in a neat and professional manner and shall be aligned, leveled, and adjusted for satisfactory operation.

C. Material and equipment shall be new, shall be of the best quality and design, shall be current model of the manufacturer, shall be free from defects and imperfections and shall have markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Material and equipment of the same type shall be made by the same manufacturer whenever practicable.

D. Installation of devices shall be performed or supervised by a National Institute for Certification of Engineering Technologies (NICET) Level 2 or higher Fire Alarm Technician. Submit copies of the certification for employees through shop drawing submittals.

1.04 APPLICABLE CODES AND STANDARDS

A. Execute Work in accordance with the National Fire Protection Association Standards and all Local, State, and National codes, ordinances and regulations in force governing the particular class of Work involved. Obtain timely inspections by the constituted authorities. Upon final completion of the Work obtain and deliver to the Owner executed final certificates of acceptance from the Authority Having Jurisdiction.

B. Any conflict between these Specifications and accompanying Drawings and the applicable Local, State and Federal codes, ordinances and regulations shall be reported to the Architect in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specification Addenda required to resolve the conflict.

C. The governing codes are minimum requirements. Where these Drawings and Specifications exceed the code requirements, these Drawings and Specification shall prevail.

D. All material, manufacturing methods, handling, dimensions, method or installation and test procedure shall conform to but not be limited to the following industry standards and codes.

1. NFPA 70, "National Electrical Code", 2020 Edition.
2. NFPA 72, "National Fire Alarm and Signaling Code", 2019 Edition.
3. Underwriters Laboratories, "Fire Protection Equipment Directory", Latest Edition.
4. International Building Code (IBC) 2021 Edition with local amendments.
5. International Fire Code (IFC) 2021 Edition with local amendments.
6. ASME A17.1, "Safety Code for Elevators and Escalators", Current Edition.

E. Contractor shall comply with rules and regulations of public utilities and municipal departments affected by connections of services.

1.05 DEFINITIONS

A. General:

1. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."
2. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
3. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."
4. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including items incidental to the Work, including services necessary for proper installation and operation. The installation shall be included under the guarantee required by this Division.
5. Engineer: Where referenced in this Division, "Engineer" is the Engineer of Record and the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in

this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the “Architect”.

6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
7. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the AHJ over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other listed Manufacturers and models that meet the specified criteria.
8. FACP: Fire Alarm Control Panel.
9. NICET: National Institute for Certification in Engineering Technologies.
10. VESDA: Very Early Smoke-Detection Apparatus.

B. The terms "approved equal", “equivalent”, or "equal" are used synonymously and shall mean “accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified”. The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

1.06 COORDINATION

A. The Contractor shall visit the site and ascertain the conditions to be encountered while installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provision for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, incorrect or faulty installation of Work under this Division or for additional compensation for Work covered by this Division.

B. The Contractor shall refer to Drawings of the other disciplines and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. The Contractor shall make offsets required to clear equipment, beams and other structural members; and to facilitate concealing piping in the manner anticipated in the design.

C. The Contractor shall maintain a foreman on the jobsite at all times to coordinate their work with other contractors and subcontractors so that various components of the Fire Alarm systems will be installed at the proper time, will fit the available space, and will allow proper service access to the equipment. Carry on the work in such a manner that the work of the other contractors and trades will not be handicapped, hindered, or delayed at any time.

D. Work of this Division shall progress according to the "Construction Schedule" as established by the Prime Contractor and their subcontractors and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of schedule dates.

E. Where coordination and interfacing with other systems or equipment is required, it shall be the responsibility of the fire alarm system installer (contractor) to either provide the relays, contacts, power supplies and other necessary hardware or see to it that such hardware is provided with the other systems or equipment.

F. The contractor shall coordinate work in this section with all related trades. Work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:

1. Sprinkler waterflow and valve tamper switches shall be provided by the fire sprinkler installer, but wired and connected by the fire alarm installer.
2. Duct smoke detectors shall be furnished, wired and connected by the fire alarm system installer. The HVAC installer shall furnish necessary duct opening to install the duct smoke detector's housing.
3. Air handling fan control circuits and contacts to be furnished by the HVAC control equipment.
4. Conduit shall be by Division 26 "Common Work Results for Electrical".

G. System shall be complete and operational with power and control wiring provided to meet the design intent shown on the drawings and specified within the specification sections.

1.07 MEASUREMENTS AND LAYOUTS

A. The drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Figured dimensions shall be taken in preference to scale dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing the Contract Documents. The Contractor will be held responsible for errors which could have been avoided by proper checking and inspection.

1.08 SUBMITTALS

A. Refer to Division 1 and General Conditions for submittal requirements, in addition to requirements specified herein. Submittals not complying fully with the submittal requirements will be rejected.

B. Contractor shall prepare installation drawings (working shop drawings) based upon this design. Requests for deviations from the approved design shall be submitted in writing to the Engineer of Record for approval.

C. Shop drawings shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations. Drawings that are not legible, or that do not contain sufficient detail to verify compliance with applicable codes and standards, will be rejected without further review.

D. Submittals and shop drawings shall not contain HEI's firm name or logo, nor shall it contain the HEI's engineers' seal and signature. They shall not be copies of HEI's work product. If the contractor desires to use elements of such product, the license agreement for transfer of information at the end of this section must be used.

E. Submit Shop Drawings as early as required to support the project schedule. Allow for two weeks Engineer review time plus mailing time plus a duplication of this time for resubmittal if required. Submit Shop Drawings as soon as possible before construction starts.

F. Before submitting Shop Drawings and material lists, the Contractor shall verify that the equipment submitted is mutually compatible and suitable for the intended use. Contractor shall verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

G. Refer to Division 1 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 1. Contractor shall notify the Architect and Engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 1, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Engineer's designated representatives. Contractor shall allow the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

H. The Engineer's checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless the Contractor has, in writing, called the Engineer's and Architect's attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve the Contractor from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.

I. Product Data: Provide a bill of materials and product cutsheets showing material specifications, electrical characteristics and connection requirements. Highlight or indicate specific product options and accessories as applicable to the project.

J. Shop Drawings:

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

2. Shop drawings shall be prepared by a NICET Level II or higher certified technician. Submit copies of the certification for the designer with submittal.
3. The fire alarm system equipment vendor shall provide shop drawings showing fire alarm floor plans and a full building riser diagram. Fire alarm floor plans and riser diagram shall show fire alarm control panel, annunciator, all fire alarm initiating devices and notification appliances. Show typical wiring diagrams of control panel/s, annunciator and each device and wiring connections required. Show all interfaces to other systems, such as temperature control systems, and security systems.
4. The fire alarm floor plans and riser diagram shall show wiring to all fire alarm devices/appliances, indicating wire sizes and quantities as well as conduit/raceway sizes and locations of end-of-line (EOL) resistors. The fire alarm floor plans and riser diagram shall clearly show the routing of all fire alarm system wiring, including all horizontal routing and vertical routing (in chases).
5. Routing of all fire alarm wiring shall comply with the "Survivability" requirements of NFPA 72.
6. Provide a Sequence of Operations Matrix that explains how the submitted fire alarm system functions.
7. Include voltage drop calculations for notification-appliance circuits.
8. Include battery-size calculations.
9. Shop drawing scale shall match the Engineer's drawings where possible. Scale shall not be less than 3/32" = 1'-0".
10. Shop drawings shall be produced using computer-aided design. Hand drawn documents will not be reviewed or approved.

K. Indicate within the submittal all applicable UL listings and all applicable approvals or certifications.

L. Qualification Data: Submit copies of the certification for the Installer.

M. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.09 ELECTRONIC DRAWING FILES

A. In preparation of shop or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall complete and send the form attached at the end of this section along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and

Engineer's release agreement form must be received before electronic drawing files will be sent.

1.010 SUBSTITUTIONS

A. Refer to Division 1 and General Conditions for Substitutions.

B. Materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.

C. No substitution will be considered prior to receipt of Bids unless written request for approval to bid has been received by the Engineer at least ten calendar days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other Work that incorporation of the substitute would require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Engineer's decision of approval or disapproval to bid of a proposed substitution shall be final.

D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner. Verbal approval will not be given.

E. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.011 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1 and General Conditions for Operational and Maintenance Manuals.

B. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.

C. The O&M Manuals shall be provided in labeled 3-ring binder with cover, binding label, tabbed fly sheets and plastic insert folders for Record Drawings. Include the following sections with the appropriate information for each section:

1. Typewritten Index.
2. Qualifications. Provide designer and installer qualification.
3. Bill of Materials. Provide complete nomenclature, model number and vendor information for all parts.
4. Operating Instructions. Complete instructions detailing operation and maintenance of all equipment installed.

5. Product Data: Provide product cutsheets for all equipment utilized and installed.
6. Riser diagram.
7. Device addresses.
8. Record copy of site-specific software.
9. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
    a) Equipment tested.
    b) Frequency of testing of installed components.
    c) Frequency of inspection of installed components.
    d) Requirements and recommendations related to results of maintenance.
    e) Manufacturer's user training manuals.
10. Manufacturer's required maintenance related to system warranty requirements.
11. Abbreviated operating instructions for mounting at fire alarm control unit and each annunciator unit.
12. Guarantee. Copy of all guarantees and warranties issued.
13. Contact list with minimum three service representative phone numbers.

1.012 RECORD DRAWINGS

A. A set of prints shall be kept on the jobsite during construction for the purpose of noting changes to location of all fire alarm equipment, devices, appliances and circuits as finally installed. During the course of construction, the Contractor shall indicate on these drawings, changes made from the Contract Drawings. Particular attention shall be made to those items which need to be located for servicing.

B. The record drawings shall show actual locations of initiating devices, notification appliances, and end-of-line devices. Show the approximate location, size and type of all wiring and routing of wiring. Drawings should also include one-line riser diagrams showing all devices.

C. The Contractor shall sign-off on the Record Drawings as being an accurate representation of the completed installation.

D. Refer to Division 1 and General Conditions for Record Drawings

E. At the completion of the project, the Contractor shall obtain at their expense, reproducible copies of the drawings and incorporate changes noted on the jobsite work prints onto these sheets. These changes shall be done by a skilled drafter. Each sheet shall be marked "Record Drawing", with date. The drawings and associated system calculations shall be delivered to the Architect.

1.013 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide 10% of the total or a minimum of one (1) manual pull station.
2. Provide 10% of the total or a minimum of two (2) of each type of automatic smoke detector.
3. Provide 5% of the total or a minimum of one (1) of each type of automatic heat detector.
4. Provide 5% of the total or a minimum of two (2) of each strobe type and candela rating.
5. Provide 5% of the total or a minimum of two (2) of each speaker type. Combination speaker/strobe units matching the units installed are acceptable.
6. Keys and Tools: One extra set for access to locked or tamper proofed components.

1.014 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products indicated in this section with minimum three years documented experience.

B. Installer: Company specializing in installing the products indicated in this section with minimum three years documented experience. Shall be bondable and licensed Contractor and employ full-time factory-trained and certified installers and technicians. Installers shall provide with the fire alarm submittal proof of factory training for each installer.

C. Final checkout and verification: Shall be conducted by a technician certified by the National Institute for Certification in Engineering Technologies (NICET) registered as level 2 or higher in the fire protection technology certification program. Provide certification information with fire alarm submittal.

D. The equipment manufacturer's service department shall be fully stocked in standard parts and components and engaged in the maintenance of fire alarm systems. On-the-premises service shall be available within 4 hours of notification, 7 days a week, 24 hours a day.

1.015 GUARANTEES AND WARRANTIES

A. Refer to Division 1 and General Conditions for Guarantees and Warranties.

B. Furnish service and maintenance of fire alarm system including wiring and raceways for one year from date of substantial completion.

C. All components, system software, parts and assemblies shall be guaranteed against defects in materials and workmanship for the one-year period stated above, unless

specific items are noted to carry a longer warranty in the Construction Documents or manufacturer's standard warranty.

D. Labor (including travel expenses) to trouble-shoot, repair, reprogram, or replace components shall be furnished by this contractor at no charge during the warranty period.

E. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software.

PART 2 - PRODUCTS AND MATERIALS

2.01 SYSTEM DESCRIPTION

A. Noncoded, UL-listed addressable fire alarm and mass notification system, with multiplexed signal transmission and voice/strobe evacuation.

B. All components provided shall be listed for use with the selected system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Source Limitations for Fire alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested, and will operate, as a system.

E. The mass notification signal inputs shall be retransmitted simultaneously over all building fire alarm notification circuits. The mass notification shall be programmed with the following priorities (highest first):

1. Building FACP microphone.
2. Building entrance annunciator panel microphone
3. Building local operating console microphone.
4. Building fire alarm evacuation message.
5. Public address transmissions over the building fire alarm speakers.

2.02 MANUFACTURER

A. Subject to compliance with requirements, provide products manufactured by the following manufacturers as indicated on the Drawings:

1. Siemens-Cerberus Division

2.03 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual pull stations.
2. Heat detectors.
3. Smoke detectors.
4. Carbon monoxide detectors.
5. Automatic sprinkler system water flow.
6. Fire extinguishing system operation.

B. Fire alarm signal shall initiate the following actions:

1. Identify alarm and specific initiating device at fire alarm control unit and remote annunciators (if provided).

a. A pulsing alarm tone shall occur within the control panel until acknowledged.
b. The alarm LED shall flash on the control panel and remote annunciator panel until the alarm has been acknowledged at the control panel/remote annunciator panel. Once acknowledged, this same LED shall latch on and the custom label for the address in alarm shall be displayed on the alphanumeric LCD readout. A subsequent alarm received from another address after acknowledged shall flash the alarm LED on the control panel showing the new alarm information.

2. Transmit an alarm signal to the alarm supervising station.
3. Audible notification appliances shall sound until silenced by the alarm silence switch at the control panel.
4. All visible alarm notification appliances shall display a continuous synchronized pattern until reset by the Alarm Reset Switch.
5. Record events in the system memory.
6. Unlock electric door locks in designated egress paths.
7. Release fire and smoke doors held open by magnetic door holders.
8. Activate voice/alarm communication system.
9. All fan-powered air-handling equipment shall shutdown and remain down until the fire alarm control panel is reset.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Activate preaction system.
12. Shutdown audio system.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Duct-smoke detectors
3. High- or low-air-pressure switch of a dry-pipe or pre-action sprinkler system.
4. Nitrogen generator supervisory signals.
5. Heat trace panel supervisory signals.
6. Independent fire detection and suppression systems.
7. User disabling of zones or individual devices.
8. Loss of communication with any panel on the network.

D. System Supervisory Signal Actions:

1. Identify specific device causing supervisory signal fire alarm control unit and remote annunciators (if provided).

    a) Visible and audible supervisory alarm indicated by address at fire alarm control panel.
    b) Manual acknowledge function at fire alarm control panel and remote annunciator panel silences audible supervisory alarm; visible alarm is displayed until device is returned to its normal position/supervisory condition is cleared.

2. Record events in the system memory.
3. After a time delay of 90 seconds transmit a supervisory signal to the alarm supervising station.
4. Duct-mounted smoke detectors shall shutdown their respective unit upon detection of smoke and remain down until manually reset.
5. Individual fan-powered air distribution equipment less than 2,000 cfm that is not provided with duct detection shall shutdown when the respective air handling unit is shutdown.

E. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire alarm control unit.
5. Ground or a single break in internal circuits of fire alarm control unit.
6. Abnormal ac voltage at fire alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire alarm control unit or annunciator.
10. Voice signal amplifier failure.

F. System Trouble Signal Actions:

1. Identify specific device causing trouble signal fire alarm control unit and remote annunciators (if provided).

    a) Visible and audible trouble alarm indicated by address at fire alarm control panel.
    b) Manual acknowledge function at fire alarm control panel and remote annunciator panel silences audible trouble alarm; visible alarm is displayed until device is returned to its normal position/trouble condition is cleared.

2. Record events in the system memory.

3. After a time delay of 90 seconds, transmit a trouble signal to the alarm supervising station.

2.04 FIRE ALARM & MASS NOTIFICATION SYSTEM CONTROL UNIT

A. General Requirements for Fire alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

a) System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b) Include a real-time clock for time annotation of events on the event recorder and printer.
c) Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d) The FACP shall be listed for connection to a central-station signaling system service.
e) Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
f) The control unit shall have dedicated alarm, supervisory and trouble LED's and dedicated alarm, supervisory and trouble acknowledge, and alarm silence switches.
g) Lamp Test: Manual lamp test function causes each LED to function at fire alarm control panel.
h) Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
i) The FACP shall be provided with surge protection.
j) Install in a flush mounted enclosure.
k) The fire alarm system control unit shall be UL listed for releasing service.

a. The fire alarm system control unit shall be UL listed for smoke control service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals,

supervisory signals and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. The location of the dedicated branch circuit disconnecting means shall be permanently identified at the control unit.
2. The circuit disconnecting means shall have a red marking and be provided with a breaker lock or other approved method to avoid accidental operation.
3. Alarm current draw of entire fire alarm system shall not exceed 80 percent of the power-supply module rating.

D. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead acid.
2. The secondary power system shall operate system in standby mode for 24 hours followed by alarm mode for 15 minutes.

E. System Supervision: Automatically detects and reports open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification appliance circuits. Alarm, supervisory and trouble signals shall be monitored by the supervising station over a Digital Alarm Communicator Transmitter (DACT), or other approved method.

F. Elevator Recall and Shutdown: Provide output signals to the elevator controller(s) using addressable relays to initiate elevator recall and shutdown functions per ASME A17.1. Provide equipment, output signals and logic as required by code and by the elevator system supplier and installer.

1. Elevator recall shall be initiated by any one of the following alarm-initiating devices:
   a. Elevator lobby detector(s).
   b. Smoke detector in elevator machine room.
   c. Smoke detector(s) in elevator hoistway.
   d. Heat detector(s) in elevator pit.
2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Elevator shutdown shall be initiated by any one of the following alarm-initiating devices:
   a. Heat detector in elevator machine room.
   b. Heat detector at controller location (top landing)
   c. Heat detector(s) at top of elevator hoistway.

2.05 EMERGENCY VOICE/ALARM COMMUNICATIONS SYSTEMS (EVACS):

A. The system shall incorporate one-way emergency voice communication via specified speakers. A central audible module shall provide for the necessary alarm message/tone generation, main and remote microphone connections and mixers/pre-amplifier circuits. Continuous supervision shall be provided along with

specific information as to the type of failure (main microphone trouble, tone trouble, etc.)

1. Indicate 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 comply with UL 1711.
    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 type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire alarm control unit.
2. Hand held push to talk, noise canceling microphone in recessed protective panel mounted enclosure; 5 feet coiled cable; and LED to indicate the microphone push to talk has been pressed.
3. Audible power amplifiers shall be self filtered; contain 24 volt power supply, transformer and amplifier monitor circuits; Amplifier shall operate all system speakers plus twenty-five (25) percent spare capacity.
4. Digitized voice messages are required to notify building occupants during alarm conditions. Message player shall not rely on tape or mechanical means of transmitting the voice message. A standard evacuation message shall be provided; however, the system shall be capable of transmitting a custom message of up to five (5) minutes long.
5. Alarm sequence shall consist of a temporal (3) alarm tone for a maximum of 15 seconds followed by an automatic pre-selected message. At the end of the message the tone shall resume. This sequence shall continue until the fire alarm control panel has been silenced. Manual voice paging shall be available via panel switches to page individual floors or groups of floors. Each floor shall be an individual audible zone and have a corresponding audible switch.

2.06 LOCAL OPERATING CONSOLE (LOC)

A. Locate the LOC as required by NFPA 72 and as indicated on plans. Mount the console so that the top message button is no higher than 44 inches above the floor.

B. Provide standard fire and non-fire messages and messages acceptable to the owner. At a minimum, provide messages including but not limited to:

1. Fire event
2. Severe weather event (shelter in place)
3. Hostile intruder / active shooter / lockdown
4. Outside hazard

a) Excessive heat / cold warning
b) Tornado
c) Flooding
d) Storm / lightning

5. Utility issue / power outage / gas leak
6. School / Building Closure
7. Infrastructure issues (campus system outage, internet / phone outage)
8. Modified campus travel arrangements
9. All clear

2.07 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter (DACT) shall be acceptable to the central station and shall comply with UL 864.

B. The installing contractor shall select the appropriate DACT equipment based on the available communication methods.

C. Coordinate with General Contractor to ensure proper connections are provided for communication to and from the DACT. Two (2) separate communication methods are required and shall not be subject to a common failure within the scope of work identified within these contract documents. Unless noted otherwise, the installing contractor shall utilize two (2) of the following communication methods:

1. Building 10/100 Base network (LAN), DSL modem, or cable modem.
2. GSM cellular networks in the area including 2G, 3G and 4G.

    a) The transmitter shall automatically detect and choose the best network in the area based on signal strength and immediately self-adjust for operation as necessary.

3. Other alternative method complying with the performance requirements of NFPA 72 for ‘Communication Methods for Supervising Station Alarm Systems that is acceptable to the Authority Having Jurisdiction and the Engineer of Record. Approval of any alternative methods must be obtained from the Engineer of Record via an RFI prior to submitting bids for the scope of work.

D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically transmit across the primary communication method. If service on the primary communication method is interrupted for longer than 45 seconds, the transmitter shall initiate a local trouble signal and transmit a signal indicating loss of primary communication to the supervising station over the secondary communication method. Transmitter shall automatically report communication restoration to the supervising station. If service is lost on both communication methods, transmitter shall initiate a local trouble signal.

E. Digital data transmission shall include the following:

1. Address of the alarm initiating device.
2. Address of the supervisory signal.
3. Address of the trouble signal.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

F. Secondary Power: Integral rechargeable battery and automatic charger.

G. Self-Test: Conducted automatically every 24 hours with report transmitted to supervising station.

2.08 REMOTE ANNUNCIATOR

A. Description: Alphanumeric display and LED indicating lights shall match those of fire alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

1. Mounting: Flush.
2. Provide remote microphone and emergency/voice alarm system controls.

2.09 INITIATING DEVICES

A. Manual Fire Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be 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 fire alarm control unit.
2. Station Reset: Key or wrench operated switch.
3. Indoor Protective Shield: Factory fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

B. System Smoke Detectors: Photoelectric type complying with UL 268 operating at 24-V dc, nominal with integral addressable module arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control unit.

1. Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base.
2. Device shall have an integral visual-indicating light, LED type, indicating detector has operated and power-on status.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Photoelectric detectors shall have sensitivity between 0.5 and 3.5 percent/foot smoke obscuration.

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A with a standard, relay or isolator detector mounting base. Provide manufacturer's standard housing to protect the measuring chamber from damage and insects. Provide drilling templates and gaskets to facilitate locating and mounting the housing.

1. Provide for variations in duct air velocity between 100 and 4,000 feet per minute.
2. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet.
3. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
4. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor control circuit.
5. Provide remote alarm LEDs and remote test stations as shown on the plans.
6. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.

D. Carbon Monoxide Detectors: Detector complying with UL 2075 and listed for connection to fire alarm system. Detector shall include alarm contacts and trouble contacts. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults. Locate, mount, and wire according to manufacturer's written instructions. Testable by introducing test carbon monoxide into the sensing cell. Test button simulates an alarm condition.

E. Heat Detectors – Comply with UL 521. Detector shall have twist lock base interchangeable with smoke detectors bases and be equipped with an integral addressable module arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control unit.

1. Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

2.010 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, 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, equipped for mounting as indicated, and with screw terminals for system connections. Minimum audible level and strobe intensity shall meet all requirements for separate appliances.
2. Provide strobe synchronization as required per NFPA 72.
3. Wall mounted notification appliances shall be manufacturer standard white finish.
4. Ceiling mounted notification appliances shall be manufacturer standard white finish.

B. Exterior Alarm Bells: Electric vibrating, 10-inch bell with operating mechanism behind dome and weatherproof bell kit. Sound Rating: 90 dB at 10 feet.

C. Alarm Horns: Comply with UL 464. 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 (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Alarm Speakers: Comply with UL 1480. High quality tone and voice reproduction; capacitor connected for connection to supervised notification appliance circuit; semi-flush mounting; four inch cone; high impact, flame retardant PC/ABS thermoplastic; 25 or 70 VRMS; multi-tapped output power rated ¼ to 2 watts and produce 79 to 88 dB at 10 feet.

E. Special Application Speakers (Wall Mount):

1. Atlas/Soundolier voice control loudspeaker, model number APF-15TU. Model shall be a double re-entrant type with 15 watts RMS audible power rating compression driver producing a UL-rated sound pressure level of 102 dB measured at 15 watts at 10 feet, within a frequency range of 400 Hz to 4 kHz. Loudspeaker assembly shall be furnished with mounting bracket allowing adjustment on either a vertical or horizontal plane with a single locking pin and including provisions for mounting, banding or strapping. Wiring terminals for amplifier output shall be fully enclosed and vandal–resistant adapter cover shall provide connection facilities for cable or conduit. Unit shall be finished in red baked epoxy.
2. Wheelock ET 1010 Speaker - vandal resistant loud speaker. Speaker includes both 25 and 70 volt VRMS inputs with field selectable power taps from 1/8 to 8 watts with listed sound output up to 96 dB for speakers. All models shall have provisions for standard NAC supervision and IN/OUT field wiring using terminals that accept #12 to #18 AWG wiring.

F. Special Application Speakers (Ceiling Mounted):

1. Quam UL22/25 or UL22/70 – Lay-in Speaker: UL Listed, shallow depth, lightweight, tile replacement, fire-protective signaling device with an 8C10PAFR - 8” O.D. loudspeaker, 10 oz. magnet, fire retardant components and a 4W-70V rotary select transformer. Integral enclosure is 1,412 CID

molded fiber. Grille is perforated steel with four (4) seismic tie-off points in a white powder coat finish. Line supervision capacitor is included. No assembly required.

2. Atlas/Soundolier, model number #UHT, UL listed to Standard 1480, 8-inch cone, multi-tapped design with output power of 1/2, 1, 2, 5 watt and 10 watt with either 25 or 70.7 VRMS input. Semi-flush ceiling mounted; #U51-8 standard round grille with #U95-8 enclosure (required for UL listing). Speaker output shall exceed 80 dBa at 10 feet and not exceed 120 dBa at the minimum hearing distance from the device. The speakers shall have multiple taps and shall utilize the 2-watt tap on the Atlas/Soundolier 10 watt speaker.

G. Visible Alarm Notification Appliances (Strobes): Xenon strobe lights complying with UL 1971, unfiltered or clear filtered white light, with candela ratings as indicated on drawings. Strobes shall meet all requirements of the Americans with Disabilities Act.

2.011 AUXILIARY DEVICES

A. Magnetic Door Holders: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 120-V ac.

B. Waterflow Alarm Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer. Switch shall have an adjustable delay to minimize false alarms due to fluctuations in water pressure.

C. Valve (Tamper) Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer.

D. Monitor Module: Addressable microelectronic module providing a system address for alarm initiating devices for wired applications with normally open contacts. Include address setting means on the module.

E. Control/Relay Module: Provide intelligent control relay modules. The Control Relay Module shall provide one form “C” dry relay contact rated at 2 amps @ 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

F. Fire Department Key Box: Shall be by Knox Company or as otherwise specified by the authority having jurisdiction. Provide internal switch(es), as required by the

Authority Having Jurisdiction, to indicate supervisory condition(s) at the fire alarm control and annunciator panels.

2.012 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for smoke detectors, notification appliances, or other device requiring protection as indicated on the plans.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Factory finished to match the color of the protected appliance or device.

2.013 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Power Branch Circuits: Building wire as specified in Division 26.

B. Fire alarm Wire and Cable: NRTL listed and labeled as complying with NFPA 70 (NEC) Article 760. All wiring, including wiring to existing modified devices and appliances shall be new.

C. Signaling Line, Initiating Device and Notification Appliance Circuits: Power limited fire protective signaling cable, solid copper conductor, 300 volts insulation, suitable for temperature, conditions and location installed. Minimum wire size for initiating device circuits, control circuits and notification appliance circuits shall be determined by calculations and manufacturer's requirements or recommendations. Wire and cable shall be twisted and shielded if recommended by the system manufacturer.

D. The type of cable chosen should be based on fire alarm system requirements, specification requirements and applicable code requirements. Consideration should also be given to the length of cable runs and potential interference.

E. Initiating, notification, and control circuits shall be sized based on 20% additional power consuming devices.

F. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.

G. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

H. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket and red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

I. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the class of the circuitry selected.

1. Initiating Device Circuits: Class A.

a. Pathway Survivability: Level 1.

2. Notification Appliance Circuits: Class A.

b. Pathway Survivability: Level 1.

3. Signaling Line Circuits: Class A.

c. Pathway Survivability: Level 1.

4. Any circuits interconnecting fire alarm control panels between separate buildings shall be provided with surge protection.

2.014 ACCESS TO EQUIPMENT

A. All detectors, modules, equipment, etc. shall be located so as to provide easy access for operation, service inspection and maintenance.

B. Access Doors:

1. Provide access doors for all concealed equipment, except where above lay-in ceilings.
2. Access doors shall be adequately sized for the devices served with a minimum size of 18" x 18", furnished by the respective Contractor or Subcontractor and installed by the General Contractor.
3. Access doors must be of the proper materials for type of construction where installed.
4. The exact location of all access doors shall be verified with the Architect prior to installation.
5. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
6. Frames: 16-gauge steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.
    a) For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
    b) For gypsum wallboard or plaster: perforated flanges with wallboard bead.
7. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

a) Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

8. Locking Devices: Flush, screwdriver-operated cam locks.
9. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

a) Arrow United Industries.
b) Bar-Co., Inc.
c) J.L Industries.
d) Karp Associates, Inc.
e) Milcor Div. Inryco, Inc.
f) Nystrom Building Products
g) Wade
h) Zurn

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall install, program and test all new equipment identified in this contract in accordance with the applicable codes, standards, and manufacturer's instructions.

B. The installation supervisor shall be on the job site during the entire installation. The installation supervisor shall maintain marked up copies of the drawings at the job site showing as-built conditions. These drawings shall be updated daily and available for Owner review.

C. The Contractor shall provide all required conduit and all associated hardware, and shall install (pull), connect, and test all cable for a complete fire alarm system. All wiring shall be installed in accordance with the guidelines of these specifications and documents as well as the NFPA codes and standards listed in these specifications.

3.02 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 and requirements of authorities having jurisdiction for installation and testing of fire alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Manual Fire alarm Boxes: Provide manual fire alarm boxes as shown on drawings. Mount manual fire alarm box on a background of a contrasting color. The operable part of manual fire alarm box shall be at 48 inches above floor level unless noted otherwise.

D. Smoke and Heat Detectors: Provide detectors as shown on drawings.

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat detector spacing.
3. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
5. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
6. Install ceiling mounted detectors in areas with exposed structure tight to underside of floor/roof deck unless noted otherwise on drawings.

E. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke detector housing during construction. Install detector only during system testing and prior to system turnover.
2. Provide duct detection and shutdown for fan powered air distribution equipment exceeding 2,000 cfm.

3. Provide equipment and connections to shutdown fan powered air distribution equipment with a capacity less than 2,000 cfm that are part of an air distribution system with a capacity greater than 2,000 cfm.

F. Carbon Monoxide Detections: Provide detectors as shown on drawings. The installation shall comply with manufacturer's recommendations and NFPA 720, "Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment," as referenced by NFPA 72.

G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in unsprinklered elevator shafts.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, or valve-tamper switch that is not readily visible from normal viewing position.

I. Install ceiling mounted visible and audible/visible notification appliances in areas with exposed structure to bottom of floor/roof structure or at 30 ft AFF, whichever is lower.

J. Install ceiling mounted visible and audible/visible notification appliances in areas with finished ceilings flush with bottom of ceiling or at 30 ft AFF, whichever is lower.

K. Install wall mounted visible and audible/visible notification appliances with visible element (strobe) between 80 inches and 96 inches above finished floor unless noted otherwise on drawings.

L. Install wall mounted audible devices with the top of the device at least 90 inches above finished floor or 6 inches below the ceiling, whichever is lower, unless noted otherwise on Drawings. If combination devices are installed, they shall be installed per the visible signal device requirements.

M. All notification appliance speakers shall be tapped at ½ watt unless noted otherwise on drawings. In rooms less than 100 sq ft, speakers are permitted to be tapped at ¼ watt.

N. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

3.04 PATHWAYS

A. Pathways shall be installed in conduit.

B. All detection and control circuits associated with smoke control systems shall be fully enclosed within continuous raceways.

C. Minimum allowable conduit size shall be ¾ inch. The conduit shall be sized so that conduit fill does not exceed 75% of NFPA 70 maximum fill requirements. Cables in vertical risers shall not exceed 50% of NFPA 70 maximum fill requirements. Conduit installation shall be as required by the Contractor's layout and as described in these specifications. All conduit field routing shall be acceptable to the Owner. Routing not acceptable shall be rerouted and replaced without expense to the Owner.

D. All wire, cable, conduit and raceways shall be concealed in walls, ceiling spaces, electrical shafts or closets in finished areas except as specifically noted otherwise. Conduit and raceways may be exposed in unfinished areas or where specifically approved by the Owner.

E. Except as otherwise specified or indicated on the drawings, all conduit shall be installed parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.

F. Conduit shall be located at least six inches from hot water or steam pipes, and from other hot surfaces. Conduit shall not block access to any existing equipment or fixtures.

G. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit for conventional hardwired class B initiating and notification appliance circuits.

H. Conduit shall be securely fastened to all boxes and cabinets. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit. The locknuts both inside and outside shall then be tightened sufficiently to bond the conduit securely to the box. Conduit shall enter cabinets from the bottom and sides only.

3.05 CONNECTIONS

A. All wiring shall be terminated at devices or panels using terminal connectors for screw type terminals. All terminal connectors for conductors shall be pre-insulated ring type or pre-insulated spade type. Pre-insulated terminal connectors shall include a vinyl sleeve, color coded to indicate conductor size. Pre-insulated terminal connectors shall include a metallic support sleeve bonded to the vinyl-insulating sleeve and designed to grip the conductor insulation.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC systems.

2. Provide equipment and connections to shutdown fan powered air distribution equipment with an individual capacity less than or equal to 2,000 cfm that are part of an air distribution system with a design capacity greater than 2,000 cfm.
3. Magnetically held-open doors.
4. Electronically locked doors and access gates.
5. Alarm initiating connection to elevator recall system and components.
6. Connection to disable sound systems upon alarm activation.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air pressure switch of each dry-pipe sprinkler system.
9. Supervisory connection(s) at nitrogen generator.
10. Supervisory connection(s) at sprinkler system heat trace panel.
11. Supervisory connections at elevator shunt-trip breaker.
12. Data communication circuits for connection to building management system.

3.06 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

3.07 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. All conduits and junction boxes shall be labeled as specified in Division 26 (red).

C. The location of end-of-line resistors shall be identified with a label indicating “EOL.”

D. Provide label at each initiating device indicating the device address. Label shall be visible from the floor below or immediately adjacent to the device.

3.08 GROUNDING

A. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.09 FIELD QUALITY CONTROL

A. Systems shall be checked and tested in accordance with the instructions provided by the manufacturer to insure that the system functions as required and is free of grounds, opens, and shorts. Each device shall be tested.

1. Smoke detectors shall be tested with products of combustion.

B. Upon completion of the system installation and before the Date of Final Acceptance, a factory-trained technician shall perform all necessary tests and adjustments and shall then file a Letter of Certification and a Certificate of Completion (NFPA 72) with the Owner indicating that the system functions and conforms to the Fire Alarm System Specifications.

C. Upon completion of the system installation, a factory-trained technician shall perform all necessary tests and adjustments in the presence of the Owner's designated personnel. Test in accordance with NFPA 72 and requirements of the authority having jurisdiction. Perform the following tests at a minimum:

1. Visual Inspection: Conduct visual inspection prior to testing. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    a) Test audible appliances for the public operating mode according to manufacturer's written instructions.
    b) Test visible appliances for the public operating mode according to manufacturer's written instructions.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire alarm system will be considered defective if it does not pass tests and inspections.

F. Include services of factory trained and certified technician to supervise installation, adjustments, final connections, and system testing as performed by the fire alarm contractor's factory-trained technicians.

3.010 DEMONSTRATION

A. The equipment supplier's factory trained technician shall train the Owner's personnel in the proper use and maintenance of the system. Training sessions shall be conducted as needed, not to exceed a total of 2 sessions, with each session lasting a maximum of 4 hours each.

B. Demonstrate normal and abnormal modes of operation, and required responses to each.

C. Video tape the training sessions in format as agreed to with the Owner. Provide three copies of each session to the Owner and obtain written receipt from the Owner.

END OF SECTION