

PROJECT MANUAL

FOR THE PROJECT:

**KEY LARGO SCHOOL
CAMPUS-WIDE FIRE ALARM SYSTEM AND
INTERCOM SYSTEM REPLACEMENT**
104801 OVERSEAS HIGHWAY
KEY LARGO, FLORIDA 33037

BY:

Monroe County School District
241 Trumbo Road
Key West, Florida 33040

PREPARED BY:

ANSTON-GREENLEES, INC.
Mechanical & Electrical Consulting Engineers
1315 West Fletcher Avenue
Tampa, Florida 33612
(813) 963-1919

CONSTRUCTION DOCUMENTS

February 14, 2022

AGI Project #21013.001

CONSTRUCTION DOCUMENTS

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To be issued by Monroe County School District's Purchasing Department

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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: The Project consists of a campus-wide fire alarm system replacement and intercom system upgrades at Key Largo School.

- 1. Project Location: 2104801 Overseas Highway, Key Largo, Florida 33037.

1.3 PROJECT TEAM

- A. Architect:

- 1. Architect Identification: The Contract Documents, dated February 14, 2022, were prepared for Project by Anston-Greenlees, Inc.

- B. Owner: Monroe County School Board

- 1. Project Coordinator: Jeff Barrow has been appointed by Owner to serve as Project Manager (PM).

1.4 SCOPE OF WORK

- A. The Work is indicated on the drawings and includes, but is not limited to, the following:

- 1. Cutting and patching.
 - 2. Replace all fire alarm wiring.
 - 3. Replace all fire alarm equipment and devices.
 - 4. New conduit and boxes as required
 - 5. Testing and Programming

1.5 CONTRACTS

- A. Project will be constructed under a single general construction contract with the Owner.

- B. The Contractor will enter into multiple contracts with sub-contractors or trade contractors for various portions of the work, where necessary.

1.6 USE OF PREMISES

- A. General: The Contractor shall coordinate all planned work hours with the Project Manager (PM) at the pre-construction meeting, and on an ongoing basis throughout the project, as described in other sections of this specification. Under no circumstances shall the Contractor be allowed to work during the normal school day, or when areas are occupied by any students, staff, or other parties having prior permission to use the spaces.
- B. Prior to Work: The Contractor shall provide a bar chart style schedule of planned work hours for the PM and Administration to use as a planning tool.
- C. Data network, power and telephone service must remain operational for the duration of the project. Any outages as may be necessary to perform the work of this project must occur on weekends only and services must be restored by 7:00 am Monday morning.
- D. The Owner's furniture, equipment, and boxed instructional materials will remain in the area of construction. The Contractor is responsible to cover and protect it from damage and theft, and to move it as needed to accomplish the work. The Contractor is required to return all items to the room of origin prior to requesting a substantial completion inspection.

1.7 WORK HOURS

- A. The actual start and completion times shall be mutually agreed upon between the Contractor, the PM, and the Monroe County Schools Facilities Department and all parties shall be flexible and sensitive to the needs of all parties affected. The Contractor shall coordinate and plan around all prior commitments and shall immediately notify the Engineer of any conflicts which will cause delays to the project.
 - 1. The project will only be accessible during non-occupied periods of School days (Nights and Weekends) and all non-school days (Summer Break, Thanksgiving Break, Christmas Break and Spring Break).
 - 2. Any work that reduces the ability for the active intercom system to communicate to classrooms or initiate all-call paging, must be performed when the campus is un-occupied by Students and school System Employees.
 - 3. This project shall be completed within Sixty (60) days from the Notice of Commencement.

1.8 ACCESS TO FACILITIES

- A. The Contractor shall have access to the facilities as required to accomplish the project during the schedule proposed. The PM shall make custodial staff available or make other arrangements to ensure that the Contractor has adequate access to the facilities to complete the project.

- B. Contractor's Responsibilities: It shall be the Contractor's responsibility to provide an accurate and detailed plan of what and when access to each facility will be required. This information must be provided with sufficient time for the District to make the appropriate staff schedule and room usage schedule modifications. A minimum of seven (7) calendar days shall be required for this notification.
 - 1. Daily Progress: The Contractor shall maintain daily contract with the Facilities Department to ensure that they are aware of what work has been accomplished and what work is planned on a day-to-day basis.
- C. Facilities Department Responsibilities: It shall be the Owner's responsibility to ensure that the Contractor has access to the required spaces as planned. This may be accomplished by modifying the custodial staff work hours on a temporary basis, authorizing overtime for custodial staff or even adding temporary personnel as required.

1.9 SECURITY OF FACILITIES:

- A. Contractor's Responsibilities: It shall be the Contractor's responsibility to ensure that spaces are secure while occupied by contractor's personnel. Refer to other sections of the specification for liabilities of the Contractor while in the Owner's facilities.
 - 1. Key Access: If the Contractor is provided a master key for access into and out of the facilities, it shall be the Contractor's responsibility to control that key and all access by the Contractor's personnel. The Contractor will be responsible for re-securing spaces after work has been completed. The key shall be signed for by a responsible representative of the Contractor's company and that individual shall personally maintain the key for the duration of the project. The key shall be returned at the completion of the project, prior to job closeout. The Owner reserves the right to impose substantial penalties for reproduction or loss of the key as deemed fitting.
 - 2. Contractor to provide supervision on site while any work is performed, either by the prime Contractor or any of the respective subcontractors.
- B. Owner's Responsibilities: It shall be the Owner's responsibility to determine what form of access shall be provided, either key or custodial access.
 - 1. Key Access: Provide the Contractor with a master key for access into and out of the facility.
 - 2. Custodial Access: If custodial access is provided, the custodians must be made aware that their actions will have significant impact on the Contractor's ability to perform to the contract schedule.

1.10 TEMPORARY COOLING

- A. Not applicable.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

- A. Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC1s "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- B. Conventions: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 10 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, Approved Products List, and other miscellaneous submittals.
- B. Related Sections include the following:
 - 1. Division 1 Section "Payment Procedures" for submitting Applications for Payment.
 - 2. Division 1 Section "Project Management and Coordination" for submitting Coordination Drawings.
 - 3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
 - 4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.
 - 5. Division 1 Section "Closeout Procedures" for submitting warranties, Project Record Documents and operation and maintenance manuals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Submit submittals in Adobe Portable Document Format (PDF) minimum version 4.0 with Submittal Transmittal to Architect for review.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect and Contractor reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows.

Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Allow 15 days for processing each resubmittal.
 4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Identification: Place a permanent label or title block on each submittal for identification. Provide in PDF for electronic submittals.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space beside title block to record Contractor's review and approval markings and action taken by Architect and Contractor.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Construction Manager.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.

- g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Other necessary identification.
4. Electronic PDF submittal files shall be named utilizing the specification number followed by a sequential number for the submittal made under the given specification number followed by "r#" if it is a resubmittal, and then followed by a brief description of the submitted item.
- a. The description shall indicate the actual item submitted, shall not be general in nature, and does not have to be that of the specification section heading.
 - b. Using the example, "15135-4r2 Differential Pressure Gauge"; 15135 - Meters and Gauges is the relevant specification, the " 4 shows it was the fourth submittal for specification section 15135, "1-2" shows it was the second resubmittal, and the description indicates what item is submitted.
 - c. Each specification item shall be submitted in a separate PDF file. PDF files with multiple specification items will be returned without review.
 - d. Each file shall have sufficient space allowance for the Architects review stamp(s).
 - e. Each file shall have the Contractor's review stamp(s) and indicate information required by specification 01330-1.4.E.3 above.
5. All marks made by the Contractor shall be in green.
- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Contractor observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling.

Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Construction Manager.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations.

Include the same label information as the related submittal.

2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

3. Transmittal Form: Use sample form at End of Section.
- I. Approved Products List: Submit list of covered products indicating State of Florida Approval Number and expiration date. See sample at end of section.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 33 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Close Out Documents.
 - 3. Operation and maintenance manuals.
 - 4. Warranties.
 - 5. Instruction of Owner's personnel.
 - 6. Final cleaning.
 - 7. Related Sections include the following:
 - a. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
 - b. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
 - c. Divisions 2 through 32 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

3. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
4. Complete startup testing of systems.
5. Submit test/adjust/balance records.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including floor waxing and touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
10. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - a. Multiple Inspections: The Architect's Agreement with the Owner includes one Substantial Completion Inspection for the entire project.
 - aa. If the Contractor wants additional Inspections, they will be conducted at the Contractor's expense. Cost of multiple Substantial Completion Inspections will be billed at the Architect's and Engineers' hourly rates as identified in the Architect Owner Agreement.
 - bb. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - aaa. The Architect's Agreement with the Owner includes one reinspection to determine if the Substantial Completion Punch List has been completed. Cost of more than one re-inspection will be at the Contractor's expense and will be billed at the Architect's and Engineers' hourly rates as identified in the Architect Owner Agreement.
 - cc. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."

2. Submit copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed by Construction Manager. The copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Complete and submit the Owner Training Log in the format provided at the end of this section.
4. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - aa. The Architect's Agreement with the Owner includes one inspection to determine Final Completion. Cost of more than one inspection will be at the Contractor's expense and will be billed at the Architect's and Engineers' hourly rates.
5. Submit Contractor Close Out Documents prior to requesting the final inspection. Close Out Documents are to consist of the documents listed on the attached Checklist, and any additional documents required elsewhere in the specifications.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect and Construction Manager.
 - d. Page number.

1.6 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 - aa. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - bb. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - cc. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 - dd. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - b. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

- c. Note related Change Orders, Record Drawings, and Product Data, where applicable.

1.8 DOOR KEY TRANSMITTAL FORM

- A. Not applicable.

1.9 EXTRA STOCK REQUIREMENTS

- A. See Divisions 2 through 28 specifications for any extra stock requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Complete log of activities as indicated in attached Owner Training Log.
- B. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Complete log of activities.
 - 1. Provide instructors experienced in operation and maintenance procedures.
 - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
 - 3. Schedule training with Owner, with at least seven days' advance notice.
 - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
 - 5. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
 - a. System design and operational philosophy.

- b. Review of documentation.
- c. Operations.
- d. Adjustments.
- e. Troubleshooting.
- f. Maintenance.
- g. Repair.

3.2 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition. Provide floor waxing as specified elsewhere in the construction documents.
 - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - f. Sweep concrete floors broom clean in unoccupied spaces.
 - g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials.

Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

- i. Remove labels that are not permanent.
- j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - aa. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - aaa. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - bbb. Replace parts subject to unusual operating conditions.
 - ccc. Leave Project clean and ready for occupancy.
- 2. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

SECTION 26 05 00 - BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Furnish and install all electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, cable, panelboards, etc., and arrangement for specified items in general are shown on drawings.
- C. All ampacities herein specified or indicated on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are not permitted.

1.2 MINIMUM REQUIREMENTS

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), the Florida Building Code, and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and other specification sections shall govern in those instances where requirements are greater than those specified in NEC.
- B. The rules and regulations of the Federal, State, local, civil authorities and utility companies in force at the time of execution of the contract shall become a part of this specification. In addition, the following codes and standards shall apply:
 - 1. National Electrical Code - 2017
 - 2. 7th Edition of the Florida Fire Prevention Code (2020), including NFPA-101 – Florida Specific Edition
 - 3. Florida Building Code – (FBC) 7th Edition (2020)
 - 4. 2014 State Requirements for Educational Facilities (November 4, 2014)
 - 5. Monroe County Schools – Design Guidelines and Standards, Current Issue.
- C. No work shall be done unless the Superintendent of the Contractor is on the job site. Work shall be properly protected, all rubbish removed promptly, and exposed work shall be carefully cleaned prior to final acceptance.
- D. The term "provide" shall include labor, materials, and equipment necessary to furnish and install, complete and operable, the item or system indicated.
- E. In decisions arising from discrepancies, interpretation of Drawings and Specifications, substitutes, and other pertinent matters, the decision of the Owner's representative's approval shall be final.

1.3 SPECIFICATIONS AND DRAWINGS

- A. Plans show location of fixtures and equipment and are intended to depict the general intent of the work in scope, layout and quality of workmanship. They are not intended to show in minute detail every or all accessories intended for the purpose of executing the work, but it is understood that such details are a part of this work.
- B. Where Drawings and Specifications conflict, it shall be the responsibility of this Contractor to bring such conflict to the attention of the Architect/Engineer for clarification. In general, the Architectural Drawings shall take precedence over the Mechanical Drawings with reference to building construction. All changes from the Drawings necessary to make the work conform with the building as constructed and to fit the work of other trades or to conform to the rules of authorities having jurisdiction, shall be made by the Contractor at his own expense.
- C. Keep a record of the locations of concealed work and of any field changes in Contract Drawings and Specifications for each trade and, upon completion of the job, supply "As-Built" Drawings and Specifications showing in pencil on sepia reproducibles, any deviations from the original Drawings, indicating in the Specifications each manufacturer's name underlined or inserted whose product was used on the job. These Drawings shall indicate dimensions of buried utility lines from building walls. One set of sepia reproducibles of the original tracings will be furnished upon request for this purpose.

1.4 STANDARDS

- A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where such standards have been established. Equipment and material which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
 - 1. Listed: Equipment is "listed" if of a kind mentioned in a list which:
 - a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
 - b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
 - 2. Labeled: Equipment is labeled if:
 - a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
 - b. The laboratory makes periodic inspections of the production of such equipment.

- c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
- 3. Certified: Equipment is "certified" if:
 - a. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production is periodically inspected by a nationally recognized testing laboratory.
 - c. It bears a label, tag, or other record of certification.
- 4. Nationally recognized Testing Laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.
- 5. Contractor: Any reference to Contractor shall mean the Construction Manager.

1.5 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least five years, unless otherwise noted elsewhere in the specifications or on the drawings.
- B. Product Qualification:
 - 1. Manufacturer's product shall have been in satisfactory operation on three installations of similar size and type, as this project, for approximately three years.
 - 2. The Owner reserves the right to require the contractor to submit a list of installations where the products have been in operation before approval of said products.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.6 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts should be available. Items not meeting this requirement, but which otherwise meet technical specifications, and merits of which can be established through reliable test reports or physical examination of representative samples, will be considered.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:

1. All components of an assembled unit need not be products of the same manufacturer, however, the assembled unit shall be the responsibility of a single manufacturer and warranted as such.
 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 3. Components shall be compatible with each other and with the total assembly for the intended service.
 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. All factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

1.7 EQUIPMENT REQUIREMENTS

- A. Equipment voltage ratings shall be in accordance with the requirements indicated on the drawings or as specified.
- B. Prior to bid, written approval shall be obtained by the Contractor for any equipment that differs from those specified on the drawings and specifications. The Contractor shall be prepared to submit samples of the equipment when requested at no cost to the Architect/Engineer.
1. The Contractor shall furnish drawings showing all installation details, shop drawings, technical data and other pertinent information as required to determine that the equipment is equivalent in quality and function to the equipment specified.
 2. Approval by the Architect/Engineer of the equal equipment does not relieve the Contractor of the responsibility of furnishing and installing the equipment at no additional cost to the Owner.
 3. Any other items required for the satisfactory installation of the equal equipment shall be furnished and installed at no additional cost to the Owner. This includes but shall not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and correlation with other work, subject to the jurisdiction and approval of the Architect/Engineer.
- C. Catalogue numbers, where given, are intended to give a basis for design, quality and function. Any other incidental equipment needed for a complete and functional installation shall be provided at no additional cost.
- D. EQUIPMENT PROTECTION: Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.
- E. During installation, equipment, controls, controllers, circuit protective devices, etc., shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing, operating and painting.

- F. Damaged equipment shall be, as determined by the Architect/Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
- G. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
- H. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 WORK PERFORMANCE

- A. Arrange, phase and perform work to assure electrical service for other buildings at all times.
- B. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions.
- C. Coordinate location of equipment and conduit with other trades to minimize interferences.
- D. Obtain and pay for all required installation inspections and deliver certificates approving installations to the Owner unless directed otherwise.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings. Where architectural features govern location of work, refer to architectural drawings.
- B. Working spaces shall not be less than specified in the National Electrical Code for all voltages specified.
- C. Inaccessible Equipment:
 - 1. Where the Owner/Architect/Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
 - 2. "Conveniently accessibility" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.
- D. Equipment and Material:
 - 1. New equipment and material shall be installed, unless otherwise specified.
 - 2. Equipment and material shall be designed to assure satisfactory operation and operating life for environmental conditions where being installed. NEC and other code requirements shall apply to the installation in areas requiring special protection such as explosion-proof, watertight and weatherproof construction.
- E. Utility Services:

1. When applicable, contact utility and include in the base bid all costs to the Owner for utility service, including primary raceways, concrete encasement, concrete pads, and final connections.
2. Include all costs for temporary service, temporary routing of service or any other requirements of a temporary nature associated with the utility service.

F. Continuity of Service:

1. No electrical service and no telecommunications service (voice/data, paging, fire alarm, security, TV) shall be interrupted or changed without prior permission from the Architect and the Owner. A minimum of a two week notice shall be provided and written permission shall be obtained before any work is started.
2. When interruption of services is required, all persons concerned shall be notified and a prearranged time agreed upon.

G. Concrete Work:

1. Provide all cast-in-place concrete shown on the documents unless noted otherwise. Concrete work shall conform to all applicable Division 02 and 03 specification sections.
2. Provide all anchor bolts, metal shapes and templates required to be cast in concrete or used to form concrete for support of electrical equipment.

1.10 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the National Electrical Code, install an identification nameplate which will clearly indicate information required for use and maintenance of items such as switchboard, panelboards, cabinets, safety switches, separately enclosed circuit breakers, motor starters, communications systems cabinets, control devices and other significant equipment. Refer to details on drawings for nameplates and section 26 05 53.
- B. Nameplates shall be laminated white phenolic resin with a black core with engraved lettering, a minimum of 3/16-inch high. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions. Hand written marker is not acceptable. Nameplates shall be permanently attached with rivets or tamperproof screws.

1.11 SUBMITTALS

- A. The Architect/Engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site. Submittals shall be made for all equipment and systems as indicated in the respective specification section.
- B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Architect/Engineer to ascertain that the proposed equipment and

materials comply with specification and drawing requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

- C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval. Submittals shall be submitted for all applicable products and materials specified in each individual section of these specifications.
- D. Make submittals for the equipment and materials in accordance with the following:
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 - 3. The submittals shall include the following:
 - a. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required. Provide any additional information specifically requested in the individual specification section or on the drawings.
 - b. Elementary and interconnection wiring diagrams for fire alarm, sound system, TV system and other communication systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - c. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- E. Operation and Maintenance Manuals:
 - 1. Maintenance manuals shall be complete and shall be furnished in a loose leaf binder or in the manufacturer's standard binder. Information shall be sufficient to enable a qualified technician to perform normal first line maintenance and repair. A parts list shall be included which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 - 2. Operation manuals shall be clear and concise and shall describe, in detail, the information required to properly operate the equipment specified. The manuals shall include complete catalog cuts and as-built wiring diagrams.
 - 3. Operation and maintenance manuals shall be submitted for approval prior to final inspection.
 - 4. Refer to Monroe County Schools standards for detailed requirements for the operation and maintenance manuals.
- F. In addition to the requirement of SUBMITTALS, the Owner reserves the right to request the manufacturer to arrange for the Owner's representative(s) to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.12 CUTTING, PATCHING, EXCAVATION, BACKFILL, AND LAYOUT

- A. Provide openings and excavation required for the installation of the electrical work. Patch work and backfill as required. Finished work shall match the existing adjoining work.
- B. Verify all conditions affecting the work to be performed under this contract.
- C. Carefully verify measurements at the site, determine the exact location of chases and openings required. Provide sleeves, inserts, and hangers as required. No columns, beams, joists, building foundations nor any other structural building component shall be cut, drilled or disturbed in any way. Conflicts shall immediately be brought to the attention of the Architect/Engineer.
- D. All excavation on sites containing existing buildings and existing services, shall be done with hand shovel to avoid damage to existing services. Where hand shovel is not practical extreme caution shall be taken when performing excavation. The contractor will be responsible for locating any existing utilities. Any damage incurred by the Contractor shall be repaired by the Contractor in a manner approved by the Architect/Engineer at no cost to the Owner and with no extension of time limitation.

1.13 EXPERIENCE

- A. The Contractor performing this work shall be a licensed, reputable firm, regularly performing the type of work incorporated in this project and who also maintains, as part of the firm, a service department with qualified personnel who regularly perform this type of work. The Contractor shall, upon request, show evidence of at least three jobs of similar character and size installed within the preceding two years.

1.14 ELECTRICAL WORK FOR MECHANICAL SYSTEMS

- A. Not applicable.

1.15 MOTORS

- A. All motors shall be furnished and installed under Division 23 Mechanical and shall be wired under Division 26 Electrical.

1.16 REMOVAL OF RUBBISH

- A. Contractor shall keep premises free from accumulations of waste material or rubbish caused by his employees or work. At completion of work, he shall remove all his tools, scaffolding, surplus materials, and rubbish from building and site. He shall leave premises and his work in a clean orderly condition acceptable to the Architect/Engineer.

1.17 QUIET OPERATION AND VIBRATION

- A. All equipment provided under this section shall operate under all conditions of load free of objectionable sound and vibration. Sound and vibration conditions considered objectionable shall be corrected in an approved manner.
- B. Vibration and sound control shall be by means of approved vibration eliminators or sound attenuators in a manner as specified and as recommended by the manufacturer.

1.18 CLEANING AND ADJUSTMENTS

- A. Upon completion of the work, Contractor shall clean and re-lamp all light fixtures, clean and identify all equipment, adjust and test all equipment and apparatus which he has installed and make certain such apparatus and mechanisms are in proper working order and ready to test.
- B. During construction protect all conduit and equipment from damage and dirt. Cap the open ends of all conduit and equipment.

1.19 STORAGE OF MATERIALS

- A. All materials stored on site shall be properly protected from injury or deterioration. Materials shall not be stored in contact with ground or floor.
- B. Do not remove manufacturer's packing materials until ready to install. Materials showing signs of corrosion, improper handling or storage shall be replaced at no cost to the Owner.
- C. Provide continuous protection for all equipment already installed.

1.20 WATERPROOFING

- A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Owner before the work is done.
- B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

1.21 TESTS

- A. Contractor shall make all tests required to establish the adequacy, quality, safety, completed status and satisfactory operation of all systems to the satisfaction of the Architect/Engineer. Provide all instruments, labor and services necessary to conduct tests.
- B. All conductors for the main campus electrical services, all building feeders, plus all conductors 150 amp rated and up, shall be megger tested to test insulation and connection integrity prior to permanent energization.
 - 1. Cables 600 Volts or Less: Cables 600 volts or less in size #1/0 and larger shall be meggered using an industry standard "megger" with 1000V internal generating voltage.

Readings shall be recorded and submitted to the Engineer for acceptance prior to energizing same. Values are less than 200 Mohms shall be automatic failure. Submit 5 copies of tabulated megger test values for all cables identified by the feeder name (Panel or equipment tag). Tester shall be a Megger MIT200 Series tester, or equivalent with auto discharge ensures all circuits are safely discharged after testing. 1000 V insulation test range shall have a high voltage warning prior to test voltage being applied.

1.22 INSTRUCTIONS

- A. Fully instruct Owner's personnel in the care and operation of electrical systems, including all communications, sound and fire alarm systems and furnish a letter to the Architect/Engineer advising the particular person(s) who have received such instruction.

1.23 GUARANTEE

- A. Equipment shall be started, tested, adjusted, and placed in satisfactory operating condition. Furnish a letter addressed to the Architect/Engineer advising that the completed systems have been installed in accordance with the Plans and Specifications and that they are in proper operating condition. The Owner shall receive a written guarantee covering all defects in workmanship and material for a period of one year from date of final acceptance. Any defects appearing within this year period shall be repaired without additional cost to the Owner.

1.24 ACCEPTANCE

- A. Before requesting final inspection:
 - 1. Complete all work required. If any items are held in abeyance as incomplete for final inspection, list such items together with explanation for delay.
 - 2. Submit statement that equipment is properly installed, adjusted, tested and operation is satisfactory.
 - 3. Certify in writing to the Architect/Engineer that the Owner's representative has been instructed as to the care and operation of the system and that catalog service and maintenance information has been turned over to the Architect/Engineer.
 - 4. Submit copy of written guarantees for all equipment.
 - 5. Submit copy of other data as may be outlined in these specifications, including all test data and certifications.
 - 6. See all other project specification sections for close-out and final inspection requirements.
- B. Copies of the above data shall be submitted to the Architect/Engineer prior to requesting final inspection.

1.25 SINGULAR NUMBER

- A. Where any device or part of equipment is referred to in these specifications in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.26 PHASING

- A. The contractor shall review all of the contract documents, review all phasing requirements, and visit the site to gain first hand knowledge of the existing conditions and include any work necessary to accomplish the required phasing of the work and phasing of the systems.
- B. The campus shall have an operational fire alarm system when the campus is occupied by students or staff, or a fire watch shall be provided.
- C. The campus shall have an operational intercom system when the campus is occupied by students or staff. Any intercom system downtime or temporary downtime shall be scheduled with and approved by the Owner.

1.27 DEMOLITION

- A. The existing fire alarm system shall be demolished in this project. All existing fire alarm system devices and wiring shall be completely removed. Remove any and all obsolete or demolished wiring, raceways, boxes, circuits, and equipment, including all site electrical, etc. All demolition shall be carefully coordinated with the required phasing.
- B. The existing intercom system shall be partially demolished in this project. All existing intercom system equipment, devices, and wiring that will not longer be utilized or has become obsolete shall be completely removed. Remove any and all obsolete or demolished wiring, raceways, boxes, circuits, and equipment, including all site electrical, etc. All demolition shall be carefully coordinated with the required phasing.

1.28 COMMISSIONING

- A. Not applicable.

END OF SECTION 26 05 00

SECTION 26 05 19 - WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is part of each Division-23 and -26 section making reference to electrical wires and cables specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical wire and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this section include the following:
 - 1. Copper conductors.
 - 2. Fixture wires.
 - 3. Flexible cords and cables.
 - 4. Wirenut connectors.
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
 - 1. For motor-branch circuits.
 - 2. For power distribution circuits
 - 3. For lighting circuits
 - 4. For appliance and equipment circuits

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.

- D. UL Compliance: Comply with applicable requirements of UL Std 83, "Thermoplastic-Insulated Wires and Cables", and Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".
- E. UL Compliance: Provide wiring/cabling and connector products which are UL-listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std Pub/ No.'s WC 5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy", and WC-30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.
- G. IEEE Compliance: Comply with applicable requirements of IEEE Stds 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D-753. Provide copper conductors with conductivity of not less than 98% at 20oC (68oF).

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Wire and Cable:
 - a. American Wire and Cable Co.
 - b. Anaconda-Ericsson Inc; Wire and Cable Div.
 - c. Belden Div; Cooper Industries
 - 2. Connectors:
 - a. AMP, Inc.
 - b. Appleton Electric Co.
 - c. Burndy Corporation
 - d. Thomas and Betts Corp.

2.2 WIRES, CABLES, AND CONNECTORS

- A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20oC (68oF).

- B. Building Wires: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:
1. Type THWN, THHW, XHHW, THHN/THWN: Unless otherwise indicated, all conductors for wet or dry locations requiring a conductor temperature rating of 75oC (167oF) or less. Insulation shall be flame retardant, moisture and heat resistant thermoplastic. Conductor shall be annealed copper.
 2. Type THHN, THHW, XHHW: Unless otherwise indicated, all conductors for dry locations requiring a conductor temperature rating of 90oC (194oF) or less. Insulation shall be flame retardant, moisture and heat resistant thermoplastic. Conductor shall be annealed copper.
 3. Type XHHW-2: Unless otherwise indicated, all conductors for wet locations requiring a conductor temperature rating of 90oC (194oF) or less. Insulation shall be flame retardant, moisture and heat resistant thermoplastic. Conductor shall be annealed copper.
 4. Conductors for use at 600 volts or below shall be 600 volt rated. Conductors shall be stranded copper only. Stranded conductors shall terminate in crimp type lugs.
 5. Motor circuit branch wiring and associated control wiring: Provide type THHN insulation in dry and damp locations. Provide type THHW insulation in wet locations. All motor wiring to be stranded copper.
 6. Wiring for HVAC controls, where applicable, shall be provided in accordance with the control system manufacturer/supplier requirements. Refer to HVAC controls drawings and specifications.
- C. Cables: Provide UL-type factory-fabricated cables of sizes, ampacity ratings, and materials and jacketing/sheathing as indicated for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements, NEC and NEMA standards.
- D. Connectors:
1. General: Provide UL-type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following, those types, classes, kinds, and styles of connectors to fulfill project requirements:
 - a. Type: Pressure.
 - b. Class: Insulated.
 - c. Kind: Copper (for Cu to Cu connection).
 - d. Style: Butt connection.

- e. Style: Elbow connection.
- f. Style: Combined "T" and straight connection.
- g. Style: "T" connection.
- h. Style: Split-bolt parallel connection.
- i. Style: Tap connection.
- j. Style: Pigtail connection.
- k. Style: Wirenut connection.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires, and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- C. Pull conductors simultaneously where more than one conductor is being installed in the same raceway.
- D. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
- E. Use pulling means including, fish tape, cable, rope and basket weave or wire/cable grips which will not damage cables or raceway. Any cable damaged during installation shall be completely replaced.
- F. Keep conductor splices to minimum. No joints shall be made in conductor except at outlet boxes or splice boxes. Newly installed conductors shall not be spliced unless specifically noted on the drawings. Splices shall not be permitted underground. Splices shall not be permitted in low voltage systems, such as fire alarm, intercom, etc.
- G. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Below grade splices shall be prohibited unless impossible to avoid. Any allowable below grade splice shall be completely watertight and shall utilize a splice method UL listed for wet locations.
- H. Use splice and tap connectors which are compatible with conductor material.
- I. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements

are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.

- J. At least eight inches (8") of slack wire shall be left in every outlet box whether it be in use, or left for future use.
- K. Color code wiring as follows:
 - 1. 240 volt or 120/208 volt, 3 phase, 4 wire: phase A-black, phase B-red, phase C-blue, neutral-white; ground conductor-green.
 - 2. 277/480 volt, 3 phase, 4 wire: phase A-orange, phase B-brown, phase C-yellow, neutral-white; ground conductor-green.
 - 3. All wire #6 and smaller shall be in the required color. Color coding with tape will not be accepted.
 - 4. 600 volt, 3 phase, 4 wire: phase A-orange, phase B-brown, phase C-yellow, neutral-white; ground conductor-green.
 - 5. Neutral – White.
 - 6. Ground – Green.
 - 7. Switch legs shall be the same color as the circuit supplying the power to the switch.
- L. Wire and cable boxes and reels shall bear the date of manufacture and must not bear dates by more than one year preceeding contract date.
- M. Any low voltage systems wiring (intercom, paging, voice/data, etc.) that is not installed in conduit shall be plenum rated.
- N. Minimum conductor sizes, except as specifically identified on the drawings to be larger, shall be as follows:
 - 1. No. 12 - Branch circuits of any kind, except as specified otherwise below.
 - 2. No. 14 - Signal systems, fire alarm system, unless specifically noted otherwise.
 - 3. No. 10 - Exit light circuits, emergency circuits, security lighting, security systems circuits and exterior light circuits.

3.2 FIELD QUALITY CONTROL

- A. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods section apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and schedules.
- B. Types of grounding specified in this section include the following:
 - 1. Solid grounding
- C. Applications of grounding work in this section including the following:
 - 1. Underground metal water piping
 - 2. Metal building frames
 - 3. Grounding electrodes
 - 4. Grounding rods
 - 5. Service equipment
 - 6. Enclosures
 - 7. Equipment
 - 8. Walkway canopies.
 - 9. Metal Fencing
 - 10. Playcourt structure

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3 years.

- B. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.
- C. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL-listed and labeled.
- D. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on grounding systems and any accessories.
- B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, ground rods, and plate electrodes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering grounding products which may be incorporated in the work include, but not limited to, the following:
 - 1. Burndy Corp.
 - 2. Crouse-Hinds Co.
 - 3. Thomas and Betts Corp.
 - 4. Erico

2.2 GROUNDING SYSTEMS

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

- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.
- C. Ground Rods: Copper clad, minimum 3/4" dia. x 10'. Provide longer rods if necessary for required resistivity.
 - 1. All ground rods and grounding conductor connections shall be accessible for inspection. Provide inspections wells (Eritech or equal) for each ground rod where located outside. Interior ground rods shall be located where the connection is visible yet not obstructing access or pathway. Ground rod connections shall be exothermic weld type only. Provide exothermic weld type at all other locations indicated on the drawings.
- D. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.
- E. Ground Bars:

Not applicable.

PART 3 - EXECUTION

3.1 INSPECTION

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

3.2 INSTALLATION OF ELECTRICAL GROUNDING

- A. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements and serve intended functions.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system work with other work.
- C. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity. Ground rod connections shall be exothermic weld type only. Provide exothermic weld type at all other locations indicated on the drawings.
- D. All ground connections to water service entrance shall be installed to be exposed and visible for inspection at all times. Insulation shall not be installed over ground connections. Ground rod connections shall be exothermic weld type only. Provide exothermic weld type at all other locations indicated on the drawings.

- E. A water pipe, by itself, is not an adequate grounding electrode and must be supplemented by dual grounding electrodes, a minimum of 10 feet apart, and effectively bonded together. The supplemental ground shall be per Code with the "Footing type electrode" taking precedence when possible.
- F. All ground connections shall be made on surfaces which have been cleaned of all paint, dirt, oil, etc., so that connections are bare metal to bare metal contact. All ground connections shall be tight and shall be made with U.L. listed grounding devices, fittings, bushings, etc.
- G. Duplex receptacles of any amperage shall be grounding type and shall have a separate grounding contact. A separate jumper shall be installed between the grounding terminal on the device and the metallic box. The Contractor may provide U.L. listed self-grounding receptacles in lieu of providing the separate jumper.
- H. Single and duplex receptacles shall have all grounded metal mechanically bonded together. Pressure bonding only is not acceptable.
- I. All receptacles shall be installed with the ground contacts up.
- J. In all cases where flexible metallic conduit, nonmetallic rigid conduit or liquid tight flexible conduit is used, a green wire ground conductor shall be used to provide ground continuity between the equipment of device and the conduit raceway system.
- K. Provide a separate green wire ground conductor for each branch circuit originating from each panelboard. This ground shall be used to ground the device or load fed, and shall be bonded to components of the raceway system, such as junction boxes, starter or disconnect switch enclosures, equipment cases, etc. The green wire ground conductor shall terminate in the panelboard at the green wire ground bus. Ground conductors for branch circuits shall be of size indicated in NEC, except minimum size ground conductor shall be No. 12 AWG.
- L. Each branch feeder originating at the switchboard(s) shall have a green wire ground conductor originating at the ground bus in the switchboard and terminating at the green wire ground bus in the panelboard. This green wire ground conductor shall be of size indicated in NEC except in no instance smaller than No. 8 AWG.
- M. The green wire ground conductor is in addition to the neutral conductor and in no case shall the neutral conductor serve as the grounding means.
- N. Multiple conductors in a single lug not permitted. Each grounding conductor shall terminate in its own terminal lug.
- O. All systems, such as fire alarm, intercom, sound, scoreboard, etc. shall be grounded properly.
- P. Each building grounding electrode system shall be tested for resistance to ground. The grounding system resistance shall be 5 ohms or less. Provide written certification of test results. Provide supplemental grounding rods, ground ring or other supplemental grounding to achieve the required results.
 - 1. Grounding Tests: The resistance of electrodes (main service, building feeders, transformers, etc.) shall not exceed 5 ohms and shall be measured by the Contractor before equipment is placed in operation. Testing shall be performed on all grounding

electrode installations. Testing shall be 2 point method in accordance with IEEE Standard 81. Submit all ground test readings to the Engineer in tabulated format, indicating each ground test location by main service, panel feeder tag, transformer tag, etc., at substantial completion.

END OF SECTION 26 05 26

SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to electrical supporting devices specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division-26 sections.
- B. Types of supports, anchors, sleeves, and seals specified in this section include the following:
 - 1. Clevis hangers
 - 2. C-clamps
 - 3. I-beam clamps
 - 4. One-hole conduit straps
 - 5. Round steel rods
 - 6. Lead expansion anchors
 - 7. Toggle bolts
 - 8. Wall and floor seals
- C. Supports, anchors, sleeves, and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other Division-26 sections.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of electrical supporting devices.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.
- B. Supports: Provide supporting devices of types, sizes, and materials indicated; and having the following construction features:
 - 1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" dia. hole for round steel rod; approximately 54 pounds per 100 units.
 - 2. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.
 - 3. C-Clamps: Black malleable iron; 1/2" rod size; approximately 70 pounds per 100 units.
 - 4. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
 - 5. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
 - a. **All exterior conduit straps and hardware shall be stainless steel.**
 - 6. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
 - 7. Round Steel Rod: Black steel; 1/2" dia.; approximately 67 pounds per 100 feet.
 - 8. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.
- C. Anchors: Provide anchors of types, sizes, and materials indicated, with the following construction features:
 - 1. Lead Expansion Anchors: 1/2", approximately 38 pounds per 100 units.
 - 2. Toggle Bolts: Springhead; 3/16" x 4", approximately 5 pounds per 100 units.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering anchors which may be incorporated in the work include, but are not limited to, the following:
 - 1. Abbeon Cal Inc.
 - 2. Ackerman Johnson Fastening Systems, Inc.
 - 3. Elcen Metal Products Co.

4. Ideal Industries, Inc.
 5. Joslyn Mfg. and Supply Co.
 6. McGraw Edison Co.
 7. Rawlplug Co., Inc.
 8. Star Expansion Co.
 9. Expansion Bolt Co.
- E. Sleeves and Seals: Provide sleeves and seals, of types, sizes, and materials indicated, with the following construction features:
1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or buting passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
- F. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12-gage **hot-dip galvanized steel**, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard finish, and with the following fittings which mate and match U-channel.
1. Fixture hangers
 2. Channel hangers
 3. Thinwall conduit clamps
 4. Rigid conduit clamps
 5. Conduit hangers
 6. U-bolts
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering channel systems which may be incorporated in the work include, but are not limited to, the following:
1. Greenfield Mfg. Co.; Inc.
 2. Midland-Ross Corp.
 3. OZ/Gedney Div.; General Signal Corp.
 4. Power-Strut Div.; Van Huffel Tube Corp.
 5. Unistrut Div.; GTE Products Corp.

- H. Pipe Sleeves: Provide pipe sleeves of one of the following:
1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal: 3" and smaller, 20-gage; 4" to 6", 16-gage; over 6", 14-gage.
 2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 3. Iron Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
 4. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- I. Sleeve Seals: Provide sleeves for piping which penetrates foundation walls below grade, or exterior walls. Calk between sleeve and pipe with non-toxic, UL-classified calking material to ensure watertight seal.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices. Tie wires shall not be acceptable as a means of securing conduits or boxes in ceilings, drop ceilings, walls or chases.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work. Coordinate support locations with other structural and mechanical trades. Supports shall not be attached to mechanical or electrical piping, conduit, ductwork, ceiling grid system or any other non-structural member.
- C. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings and schedules. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Liquid tight flexible metal conduit.
 - 3. Rigid metal conduit.
 - 4. Flexible metal conduit.
 - 5. Rigid non-metallic conduit.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.
- C. Codes and Standards:
 - 1. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
 - 2. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL-listed and labeled.
 - 3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of raceway system required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each service indicated.
- B. Rigid Steel Conduit: Provide rigid steel, zinc-coated, threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6.
- C. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated, conforming to FS W-F-408, ANSI C80.4.
 - 1. Use compression type fittings for raintight connections.
 - 2. Use compression type fittings for other miscellaneous connections.
- D. Electrical Metallic Tubing (EMT): FS WW-C-563, ANSI C80.3 and UL 797.
- E. EMT Fittings: FS W-F-408, ANSI C80.4. Steel or malleable iron.
 - 1. Use compression fittings for raintight connections.
 - 2. Use compression type for concrete type connections.
 - 3. Use compression type fittings for miscellaneous connections and connections in inaccessible locations.
 - 4. Set screw may be used for interior EMT use only.
 - 5. All EMT connectors up to 1" must have insulated throat.
 - 6. No EMT shall be encased in concrete slabs or columns.
 - 7. All installed concealed EMT conduits shall be placed against masonry block or concrete will be wrapped with Scotchrap 3M, 50 all weather corrosion protection tape or equivalent.
 - 8. All EMT and rigid metal conduits passing through masonry walls shall be wrapped with Scotchrap 3M, 50 all weather corrosion protection tape or equivalent.
- F. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and

outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC). Shall be Sealtite or equal.

- G. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G. Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
- H. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spiral wound, interlocked zinc-coated strip steel.
- I. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
 - 1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - 2. 45o or 90o Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

2.2 NONMETALLIC CONDUIT

- A. General: Provide nonmetallic conduit, ducts, and fittings of types, sizes, and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC for raceways.
- B. Electrical Plastic Conduit:
 - 1. Heavy Wall Conduit: Schedule 40, 90 C, UL-rated, construct of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or normal above ground use, UL-listed and in conformity with NEC Article 347, ANSI C33.91.
- C. PVC Conduit and Tubing Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.

2.3 MANUFACTURERS

- A. Subject to compliance with requirements, provide conduit bodies of one of the following:
 - 1. Appleton Electric; Div of Emerson Electric Co.
 - 2. Arrow-Hart Div; Crouse-Hinds Co.
 - 3. Bell Electric Div; Square D Co.
 - 4. Gould, Inc.
 - 5. Killark Electric Mfg. Co.
 - 6. O-Z/Gedney Div; General Signal Co.

7. Spring City Electrical Mfg. Co., or equivalent.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF RACEWAYS

- A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NEC, and NECA's "Standards of Installation". Install units plumb and level, and maintain manufacturer's recommended clearances.
- B. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.
- C. ENT electrical non-metallic tubing, (i.e. flex, smurf pipe, etc.) will not be allowed or accepted under any conditions.
- D. MC Cable will not be allowed or accepted under any conditions.
- E. Provide all raceways, boxes and wiring for HVAC controls. Refer to specification section 23 0900, and the HVAC controls drawings for requirements

3.3 INSTALLATION OF CONDUITS

- A. General: Install concealed conduits in new construction work, either in walls, slabs, or above hung ceilings. Run conduits concealed in existing work where practical or specifically indicated on the drawings..
 1. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings, and cabinets to provide electrical continuity and firm mechanical assembly.
 2. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
 3. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' linear run or wherever structural expansion joints are crossed.
- B. Conduit Installation: Follow minimum requirements in all areas as follows:

1. Use rigid steel galvanized conduit in crawl spaces, service splines, where exposed to weather or subject to saturation with liquids. Also use rigid steel galvanized conduit for all underground conduit risers from underground.
 2. Steel EMT may be used above hung ceilings in classrooms, offices, corridors, toilets, lab areas and other areas where rigid steel or pvc is not required. EMT shall not be installed encased in concrete slabs or columns. All installed concealed EMT conduits shall be placed against masonry block or concrete will be wrapped with Scotchrap 3M, 50 all weather corrosion protection tape or equivalent.
 3. Use galvanized rigid steel conduit or PVC heavy wall (Schedule 40) when raceways run below grade, under floors on grade or in concrete. All risers to cabinets and boxes when conduit is to be exposed shall be rigid steel conduit. Provide yellow warning tape with metallic fender 12 inches above conduit for all underground conduits.
 4. Conduit in walls to recessed panels and boxes shall be in accordance with NEC. PVC up to first point of termination with 4'-0" maximum in wall and EMT above 4'-0". Exposed PVC raceways or pvc boxes are not permitted anywhere.
 5. Use flexible conduit in movable partitions and from outlet boxes to lighting fixtures, and final 24" of connection to motors, control items or any equipment subject to movement or vibration, and in cells of precast concrete panels. MC cable is not approved for use. Flexible conduit shall not be routed from lighting fixture to lighting fixture.
 6. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
 - a. Exterior location.
 - b. Moist or humid atmosphere where condensate can be expected to accumulate.
 - c. Corrosive atmosphere.
 - d. Subjected to water spray or dripping oil, water, or grease, including kitchen areas.
 7. **Use hot-dipped galvanized conduit where conduit is routed outdoors or in any way exposed to weather – no exceptions – no pvc. Use stainless steel fasteners and straps.**
 8. Electrical contractor will be responsible for the following for all underground conduits:
 - a. Trenching and Excavation
 - b. Backfill
 - c. Compaction
- C. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
- D. Field bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

- E. Minimum conduit size shall be 1/2" unless noted otherwise. Homeruns shall be a minimum 3/4".
- F. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts, and terminate with bushings. Install locknuts inside and outside enclosure. Provide grounding bushings on all metal raceways.
- G. Conduits are not to cross pipe shafts, or ventilating duct openings.
- H. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
- I. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
- J. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- K. Install conduits so as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
- L. Exposed Conduits:
 - 1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
 - 2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
 - 3. Support all conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'-0"; 1-1/4" and over: 8'-0". All conduits shall be adequately supported to prevent any noticable deflection, vibration or rattle.
 - 4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
 - 5. Exposed pvc conduit is not permitted.
 - 6. Exposed conduit shall not be permitted in occupied spaces, except where specifically identified or approved.
 - 7. All exposed exterior fasteners, anchors, supports, and mounting hardware shall be stainless steel.
- M. Conduit Fittings:
 - 1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
 - 2. Bushings for terminating conduits smaller than 1- 1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

3. Install insulated type bushings for terminating conduits 1-1/4" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
4. All bushings of standard or insulated type to have screw type grounding terminal.
5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.
6. All locknuts must be steel.
7. Exterior raceway straps and fasteners shall be stainless steel.

N. Concealed Conduits:

1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.
2. Conduit in concrete slabs: Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond. Conduits must have a minimum of three-quarter inch (3/4") concrete cover.
3. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness. Conduit shall not be run in slabs less than 3 inches thick.

O. Underground Duct Banks and Underground Conduits: All underground conduits shall be installed per the National Electrical Code, in accordance with standard industry practices and in accordance with other sections of these specifications. Conduits in duct banks shall be neatly and securely installed in straight lines with manufactured elbows used for all turns and bends. Provide all required trenching, excavation, backfill, compaction, supports, manholes, etc. for a complete installation. Trenching, excavation, backfill and compaction shall be performed in accordance with applicable Division 2 and Division 3 sections of these specifications. Provide a yellow warning tape along the full length of all underground primary and secondary conduits. Tape shall be 12 inches above conduit.

1. As-built drawings shall documents the dimension of the actual location of all underground conduits. A minimum of two dimensions from building reference points shall be provided and a bury depth indicated.

P. Painting of Conduit & Boxes:

1. Fire Alarm: All new fire alarm conduit, including underground conduit, shall be spot painted red at a minimum of every 4 feet, nominally. Underground conduit shall be spot painted red after it is laid in trench and made up tight. All fire alarm junction boxes shall be painted red.
2. 208Y/120 volt Power: All new junction boxes above ceiling shall be painted brown.
3. 480Y/277 volt Power: All new junction boxes above ceiling shall be painted orange.

3.4 INSTALLATION OF RACEWAYS AND WIREWAYS

- A. General: Mechanically assemble metal enclosures, and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
 2. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
 3. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
 4. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported. Supporting conduits from ceiling grid, other conduits, ductwork or other non-structural members will not be permitted.
 5. Use boxes as supplied by raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.

3.5 TELEPHONE/DATA RACEWAY

- A. Telephone and data raceways shall be provided for each telephone and/or data outlet indicated on the drawings. Conduit shall be a minimum 1" inch from each outlet to the ceiling space. Provide the end of the conduit with a non-metallic protective bushing. See the voice/data network infrastructure specifications for further requirements.

END OF SECTION 26 05 33

SECTION 26 05 35 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this section include the following:
 - 1. Outlet boxes
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Floor boxes
 - 5. Bushings
 - 6. Locknuts
 - 7. Knockout closures
 - 8. Manholes and handholes

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

- D. UL Compliance: Comply with applicable requirements UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2, and Pub 250 pertaining to outlet and device boxes, covers, and box supports.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

- A. Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding. All 1900 boxes, (4" square), junction boxes, and gutters installed against masonry block or concrete shall have corrosion protected material installed on backs of their enclosures.
 - 1. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cableclamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
- B. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
 - 1. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering outlet boxes which may be incorporated in the work include, but are not limited to, the following:
 - 1. Appleton Electric;
 - 2. Bell Electric;
 - 3. Eagle Electric Mfg. Co.; Inc.
 - 4. Midland-Ross Corp.

5. OZ/Gedney; General Signal Co.
 6. Pass and Seymour, Inc.
 7. RACO Div.; Harvey Hubbell Inc.
 8. Thomas & Betts Co.
- D. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering raintight outlet boxes which may be incorporated in the work include, but are not limited to, the following:
1. Appleton Electric;
 2. Crouse-Hinds Co.
 3. Bell Electric;
 4. Harvey Hubbell, Inc.
 5. OZ/Gedney; General Signal Co.
 6. RACO Div.
- F. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes; with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering junction and pull boxes which may be incorporated in the work include, but are not limited to, the following:
1. Appleton Electric; Emerson Electric Co.
 2. Arrow-Hart Div.; Crouse-Hinds Co.
 3. Bell Electric; Square D Company
 4. OZ/Gedney; General Signal Co.
 5. Spring City Electrical Mfg. Co.
- H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor boxes which may be incorporated in the work include, but are not limited to, the following:
1. Arrow-Hart Div.; Crouse-Hinds Co.

2. Harvey Hubbell, Inc.
 3. Midland-Ross Corp.
 4. Spring City Electrical Mfg. Co.
- I. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connections, of types and sizes, to suit respective installation requirements and applications.
- J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering bushings, knockout closures, locknuts, and connectors which may be incorporated in the work include, but are not limited to, the following:
1. Arrow-Hart Div.; Crouse-Hinds Co.
 2. Appleton Electric Co.; Emerson Electric Co.
 3. Bell Electric; Square D Co.
 4. Midland-Ross Corp.
 5. OZ/Gedney Co.; General Signal Co.
- K. Manholes and Handholes: Manholes and handholes for exterior use shall be pre-cast concrete with steel traffic rated covers, as manufactured by Brooks or equal. Manholes and handholes shall be the size necessary for the number of conduits and conductors indicated on the drawings which will enter the enclosure, plus the necessary capacity for the spare conduits and the associated estimated conductor fill. Provide manholes with the appropriate drainage and knockouts for conduits and other necessary access. Traffic covers shall be engraved with the appropriate identification, such as "ELECTRIC".

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weathertight boxes and fittings for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

- F. Avoid installing boxes back-to-back in walls. Provide not less than 24" (600 mm) separation.
- G. Position recessed outlet boxes accurately to allow for surface finish thickness.
- H. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- I. Each circuit in pull box shall be marked with a tag guide denoting panels which they connect to.
- J. Manholes and handholes shall be installed for all underground conduit installations. The minimum number of manholes and handholes shall be as indicated on the drawings. The contractor shall provide any additional handholes or manholes necessary for ease of installation, code compliance or due to voluntary or required re-routing of the underground conduits at no additional cost to the Owner.

END OF SECTION 26 05 35

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods section apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical identification work is indicated by drawings and schedules.
- B. Types of electrical identification work specified in this section include the following:
 - 1. Electrical power, control, fire alarm, and communication conductors.
 - 2. Operational instructions and warnings.
 - 3. Equipment/system identification signs.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Std 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical identification products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Brady, W.H. Co.

2.2 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.3 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (white letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - 1. Thickness: 1/8", except as otherwise indicated.
 - 2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.4 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.
 - 1. Consult Owner or Engineer prior to making nameplates for proper notation.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. General Installation Requirements:
 - 1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
 - 2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
 - 3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.2 OPERATIONAL IDENTIFICATION AND WARNINGS

- A. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and doors of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

3.3 EQUIPMENT/SYSTEM IDENTIFICATION

- A. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated on the detail on the drawings, provide single line of text, 1/2" high lettering, on 1-1/2" high sign (2" high where 2 lines are required), black lettering in white field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs/nameplates for each unit of the following categories of electrical work:
 - 1. All low voltage system control panels and terminal cabinets
 - 2. Intercom control panel(s), amplifiers, switch banks, and all terminal cabinets. All main components of the intercom system shall be labeled so it is obvious they are intercom system equipment components. All wiring shall be labeled.
 - 3. Fire alarm panels, power supplies, and terminal cabinets.
- B. Install signs and labels at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.
- C. Fire alarm pull station signs shall be provided at all exterior doors that have a pull station inside, adjacent to the door. Signs shall read "FIRE ALARM PULL STATION INSIDE".

END OF SECTION 26 05 53

SECTION 27 51 23 – COMMUNICATION (INTERCOM) SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. The conditions of the General Contract (General, Supplementary, and other Conditions) and the General Requirements are hereby made a part of this Section.
- B. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of the Bogen Nyquist E7000 Series Educational System. The specifying authority must approve any alternative system.
- C. Contractors who wish to submit alternative equipment shall provide the specifying authority with the appropriate documentation at least 15 business days prior to bid opening. The submitted documentation must provide a feature by feature comparison identifying how the proposed equipment meets the operation and functionality of the system described in this specification. Prior to bid date, the contractor shall provide adequate and complete submittal information, which shall include but not be limited to specification sheets, working drawings, shop drawings, and system demonstration. The alternative supplier-contractor must also provide a list to include six installations identical to the proposed system.
- D. The contractor shall provide the FCC registration number of the proposed system, where applicable.
- E. Final approval of the alternative system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternative system at the contractor's expense.
- F. The contractor for this work shall have read all the bidding requirements, the general requirements of division 00 and 01, and the contract proposal forms, and shall be held to the execution of this work. The contractor shall be bound by all the conditions and requirements therein.
- G. The contractor shall be responsible for providing a complete functional system, including all necessary components whether included in this specification or not.
- H. In preparing the bid, the contractor should consider that no claim will be made against the owner for any costs incurred by the contractor for any equipment demonstrations requested by the owner.

1.2 SCOPE OF WORK

The contractor shall furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating VoIP school communications system including but not limited to a new Bogen Nyquist head end with controller, amplifiers, pre-amps, analog-to-digital bridges, speakers, call-in switches,

integration into the campus VoIP phone system, and all associated wiring, programming, testing, training and the following.

- A. Built-in Master Clock with the following minimum features:
 - 1. Unlimited Events
 - 2. Unlimited Concurrent Schedules
 - 3. Unlimited Holidays
- B. Nyquist E7000 Series Educational System Software shall be installed on a dealer or a customer-supplied server with the following minimum specifications:
 - 1. Web Server for full system configuration and operation
 - 2. Nyquist web-based Administrative User Interface (Admin Web UI) for programming and day-to-day system operation, including but not limited to:
 - a. Station intercom two-way calling
 - b. Zone Paging with software-adjustable volume per zone
 - c. Emergency Paging
 - d. Playing Emergency Tones
 - e. Playing Tones
 - f. Playing Announcement Files
 - g. Managing Bell Schedules
 - h. Weekly Bell Schedule Review at-a-glance
 - i. Audio Distribution
 - j. System muting
- C. Teacher's Dashboard web-based UI for teachers (future), including but not limited to:
 - 1. Directory
 - 2. Dial Pad
 - 3. Voicemail
 - 4. Call Forwarding
 - 5. Single-click or touch Normal or Emergency calling
 - 6. Single-click or touch 911 calling
- D. VoIP Admin Phone, PoE, 7" 800 x 480-pixel color touch screen with backlight, Provide a minimum of two.
- E. Owner Telephone System Connectivity
 - 1. System shall be capable of connecting to campus VoIP phone network system.
 - 2. Telephone service with public utilities will be arranged by the owner in conjunction with the equipment supplier. Equipment supplier shall generate a one-page document that will provide the owner with the number of outside lines.
 - 3. All offices in the building that do not have an existing call in station shall be provided with the ability to use the intercom system via their VoIP phone handset. These spaces shall include the Principal, Assistant Principal, PE Coach offices, etc.
 - 4. Move connections to the Campus phone system so that the offices using their VoIP phones will be able to access the intercom system. System shall be tested with the VoIP phones and phone systems and make sure it is operational.

- F. The existing interior analog speakers shall remain and be connected into the new IP based intercom system. Provide all required wiring and interconnection equipment and devices. Provide all required analog bridges for a complete functional system. Provide all new speakers for the exterior speakers.
- G. The existing analog call in buttons shall be removed and replaced with new call-in switches and be connected into the new IP based intercom system. Existing call-in switch wiring may be reused. Provide all required analog bridges for a complete functional system
- H. Integrate the system into the Bogen BCMA clock system.
- I. Integrate into the audio enhancement alert system for emergency communications via the existing audio enhancement system in each classroom. Provide required wiring and relays.

1.3 SUBMITTALS

- A. Detailed Spec Sheets on all equipment and device items including all cable types. Mark all items in red or other means to identify the specific item selected.
- B. Outline drawing of system rack layout elevation showing relative position of all major components.
- C. Shop drawings, detailing integrated electronic communications network system including, but not limited to, the following:
 - 1. Station wiring arrangement with analog-to-digital bridge wiring shown
 - 2. Equipment cabinet/rack detail drawing
- D. Wiring diagrams showing typical connections for all equipment
- E. Submit clock system as an integrated submittal with the IP intercom system submittal at the same time.
- F. Provide amplifier calculations for exterior speakers, including 20% spare capacity minimum.
- G. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed
- H. Numbered Certificate of Completion for installation, programming, and service training, which identifies the installing technician(s) as having successfully completed the Nyquist E7000 technical training course provided by the Bogen Communications, Inc.
- I. At Substantial Completion: Submit a numbered Certificate of Completion for installation, programming, and service training, which identifies the installing technician(s) as having successfully completed the technical training course(s) provided by the system manufacturer.

- J. Close-out: Provide as-built drawings and as-built shop drawings and submittals. Provide two copies of the final programming on disk (CD). One copy shall be left with the system in the MDF room and the other turned into the Owner.

1.4 QUALITY ASSURANCE

- A. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.
- B. The contractor shall be an established communications and electronics contractor that maintains a locally run and operated business and has done so for at least 10 years. The contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.
- C. The contractor shall show satisfactory evidence, upon request, that he or she maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The contractor shall maintain at his or her facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

1.5 SINGLE SOURCE RESPONSIBILITY

- A. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and a minimum of 30 years of experience in the industry. The supplying contractor shall have attended the manufacturer's installation and service training classes. A certificate of this training shall be provided with the contractor's submittal.

1.6 SAFETY / COMPLIANCE TESTING

- A. The communications system and its components shall, where applicable, bear the label of a Nationally Recognized Testing Laboratory (NRTL), such as Environmental Technology Laboratory (ETL), and shall be listed by their re-examination service. All work must be completed in strict accordance with all applicable electrical codes, under direction of a qualified and factory-approved contractor, and to the approval of the owner.

1.7 IN-SERVICE TRAINING

- A. The contractor shall provide a minimum of eight hours of in-service training with this system. These sessions shall be broken into segments, which will facilitate the training of individuals in the operation of this system. User Guides shall be provided at the time of this training.

1.8 WIRING

- A. System wiring and equipment installation shall be in accordance with generally-accepted engineering best practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall be tested to be free from grounds and shorts.
- B. All system wiring shall be labeled at both ends of the cable. All labeling shall be based on the room numbers as indicated in the architectural graphics package.
- C. Wiring shall be done per manufacturer's recommendation (Cat 5e/6 or West Penn #357) depending on speaker type. All terminal connections are to be on barrier strips.

1.9 PROTECTION

- A. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.
- B. The contractor shall note on their system drawings, the type and location of these protection devices and all wiring information. Such devices are not to be installed above the ceiling.

1.10 SERVICE AND MAINTENANCE

- A. The contractor shall provide a five-year equipment hardware warranty of the installed system against defects in material and workmanship. All materials shall be provided at no expense to the owner during normal working hours. The warranty period shall begin on 1st of the month following the date of shipment.
- B. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of this system after the initial hardware and software warranty periods.
- C. System shall include software maintenance that includes bug fixes and new feature releases for a period of six years.
- D. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

1.11 WARRANTY

- A. Provide five-year warranty of the Intercommunications, School safety, Paging, and Clock System against defects in material and workmanship. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a five year warranty shall be provided for labor.

PART 2 – PRODUCTS - SYSTEM SPECIFICATION

2.1 MANUFACTURERS

- A. Manufacturers, subject to compliance with requirements specifications, provide the following system:
- B. Bogen Nyquist E7000 Series Educational System manufactured by Bogen Communications, Inc.
- C. The specifying authority must approve any alternative system via official addendum prior to bid day. Any request for substitution shall be submitted a minimum 14 days prior to bid date. Submit a complete shop drawing package for review.
- D. The intent is to establish a standard of quality, function, and features. It is the responsibility of the contractor to ensure that the proposed product meets or exceeds every standard set forth in these specifications.
- E. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

2.2 EQUIPMENT

- A. Nyquist NQ-E7030 Analog Station Bridge
 - 1. 24 station interface supporting analog speakers and call switches
 - 2. Built-in 2x120W power amplifiers. 120W of total available power per amp. 40W per any individual port
 - 3. Shall support 25/70-volt speaker(s), ceiling-mounted, wall-mounted, and paging horns
 - 4. Analog/Mechanical Call Switches capable of placing Normal, Urgent, or Emergency priority calls
 - a. CA-15C rocker style momentary call button
 - 5. CAN Bus 2.0 interface designed for future support of Nyquist Digital Call Switch (DCS) NQ-E7020 that can initiate Normal, Urgent, or Emergency priority calls, all with options for Privacy Mode
 - 6. Software programmable configuration and operation
 - 7. Rack mounted, wall mounted, or shelf mounted
- B. Nyquist NQ-P0100 Matrix Mixer Pre-amplifier
 - 1. No less than four Line/Microphone Level Inputs used for:
 - a. CD Player
 - b. AM/FM Tuner
 - c. Push-to-Talk Paging Microphone
 - d. MP3 Player

- e. Digital AES/EBU (AES3) input
 - 2. Line Level output to drive external amplifier
 - 3. Software programmable configuration and operation
 - a. Push-to-Talk Channel
 - b. Push-to-Talk Type
 - c. Push-to-Talk Zone
 - d. Mixer Channels
 - 4. Mixer Channels Wall or shelf mounted
- C. Nyquist NQ-E7010 Input/Output Controller
- 1. Eight Dry Contact Inputs
 - 2. Eight Open Collector Outputs
 - 3. Software programmable configuration and operation including:
 - a. Contact Type
 - b. Extension
 - c. Name
 - d. Close Interval
 - e. Actions including:
 - 1. Audio
 - 2. Alarm
 - 3. Announcement
 - 4. Disable-Audio
 - 5. Other
 - 6. Tone
 - 7. Enable-Audio
 - f. Action ID
 - g. Zones
 - h. Close Extension
 - i. Dashboard Type
 - j. Dashboard Title
 - k. Dashboard Scope
 - l. Dashboard Text
 - m. Dashboard Style
 - n. Email
 - 4. Wall or shelf mounted
- D. Nyquist Station Equipment
- 1. NQ-T1100 VoIP Admin Phone – Color Touch Display (aka Admin Station)
 - 7. CA15C Analog Call Switch
- E. Optional Equipment (provide as required for system operation)

1. Telephony interface device(s) for FXO/FXS analog port connectivity
2. Accessories for mounting speakers, back boxes, tile bridges, etc.

2.3 COMPONENTS AND DESCRIPTIONS

The Nyquist E7000 Series Educational System is a software-based VoIP paging and intercom system.

The Nyquist E7000 Series Educational System must be capable of supporting existing Bogen Multicom 2000 and Bogen Quantum Multicom IP wiring, 25 volt speakers and analog call-switches, and equivalent competitive systems utilizing the existing architectural numbering scheme. The VoIP capabilities of the Nyquist system will enable the support of the features across the various Nyquist appliances within the facility. The following sections define how the system handles each of the features in the system. Systems that do not allow the reuse of existing wiring or numbering scheme shall not be deemed acceptable. Systems that do not allow appliances to be seamlessly integrated via the LAN are not considered equal.

A. Nyquist E7000 Server Software

1. The Nyquist E7000 server software shall be installed on a dedicated dealer or customer supplied server. An unlimited number of facilities can be networked into a Nyquist-based District.
 - a. Minimum Nyquist Server Requirements
 - Debian Linux OS (AMD 64-bit version) release 8.4.x – 8.8.0
 - Quad-core Intel-based processor running at 3.0 GHz or higher
 - 8 GB RAM
 - One 250 GB disk drive
 - Redundant Array of Independent Disks (RAID) is recommended for redundancy and high availability.
 - Consider using a larger drive if large amounts of audio (for example, voice mail, announcements, recordings, and music) are being stored on the system. Other factors that should be considered are:
 - How often will backups be performed?
 - Will the system be backed up locally or remotely on a detachable drive, SAN/NAS, or NFS?
 - How many users will have voicemail ability?
 - How long will voicemail messages be stored?
 - Will voicemail messages be part of the local system backups?
 - NIC 10/100/1000 MB Ethernet port
 - One or more PCI/PCI Express (PCIe) slots if telephony network connectivity other than, or in addition to, SIP trunking
 - One or more PCI/PCIe type third-party telephony interface cards (for example, FXO, FXS, etc.) if telephony network connectivity other than, or in addition to, SIP trunking
2. Audio shall be transmitted between the server and the Nyquist appliances using the customer supplied LAN/WAN using both G.722 and Opus 48k audio encoding and

- streaming technology to deliver High Definition audio quality. Systems that do not use G.722 and Opus for audio encoding and streaming shall not be deemed equivalent.
3. The Nyquist server software and Nyquist appliances software shall be upgradeable via the Nyquist Web UI.
 4. It shall be possible for a Nyquist facility to make “station-to-station” calls and “remote facility” All-Call pages to a single facility or to all Nyquist facilities in a district via the Nyquist Web UI or an Admin Station. Systems that require remote viewing software or other application software to be installed/loaded on to additional servers or PCs to make station-to-station calls and remote facility All-Call or district paging shall not be considered equivalent.
 5. The Nyquist server software is designed to handle all facility and district-wide communications, including but not limited to, inter-facility intercom calling and paging, district-wide Emergency All-Call and local facility point-to-point calls. Via the Nyquist Web UI, every facility shall be configured with the IP addresses of all the other remote facilities within the district.
 6. Nyquist can support an unlimited number of facilities; however, the maximum number of simultaneous remote facility intercom calls supported is based on the actual performance of the WAN and the Nyquist Server CPU load.
 7. The voice quality of the facility calls may vary based on the WAN conditions. The maximum network bandwidth that All-Call and Zone Paging uses is 64 kbps (Multicast G.722), and intercom calls use 128 kbps (unicast, G.722).
 8. The system shall facilitate the repetitive playing of Normal or Emergency audio tones or announcements directed to a Paging Zone until stopped by the Nyquist user via the Web UI, an Admin Station, or a dry contact closure connected to the Nyquist I/O Controller NQ-E7010.
 9. A built-in Master Clock shall be included to automatically control class change bells or other time-based signals. The Master Clock shall have an unlimited number of Events that may be programmed into any of the unlimited number of Schedules, and unlimited number of Holidays. The schedules shall be nameable for easy selection when assigning schedules to days or overriding a schedule.
 10. Network Time Synchronization. The system shall be capable of periodically updating/synchronizing the processor’s time with a Network Time Server running Network Time Protocol (NTP) via the school’s LAN network. Systems that do not provide Network Time Synchronization will not be deemed equivalent. The Nyquist server can be the NTP server for other devices on the LAN such as IP clocks and other IP devices.

B. Nyquist Server Application

1. The Nyquist software is installed onto the server, and upon boot-up, users can log in to the Nyquist server application via a web browser that supports WebRTC. Systems that require Com Port redirect software, client PC application, software or serial-to-Ethernet adapters for user access are not deemed equal. Communications between the server and the Web UI(s) shall be via secure Hyper Text Transfer Protocol (HTTPS) connections (i.e., <https://>).
2. The Nyquist Web UI shall be configured with four different default user access levels, based on four unique user roles. Systems that do not provide unlimited access levels and unlimited user roles are not considered equal.
 - a. The four default roles shall be: admin, optech, operator, and user. These roles provide a starting point/example for administrators to create additional roles.

3. Only a user assigned the admin role shall be able to provide access to users, giving them the ability to create, delete, edit, and view system parameters.
4. Only an Administrator shall have the ability to adjust roles and Class of Service (CoS) of users. The roles determine if users can view the definable data objects that can include configuration, alarms, and performance data and if users can perform certain operations based on the user's role and station's CoS. All changes to roles and CoS are effective immediately, without the need to restart the browser or reboot the server.
5. The Nyquist Web UI Dashboard shall provide full administrative capabilities to manage/operate the following system features:
 - a. Calling/Paging – User can initiate a call by accessing the directory or by dial pad and can receive calls, make Zone Page and All-Call Page, make a Prepending Page, Emergency All-Call paging.
 - b. Call Forwarding
 - c. District Calling/Paging – Used for District Facility Page, District All-Call, and District Emergency All-Call.
 - d. Tones/Announcements – Used to play Tones, Announcements, and Alarms.
 - e. View This Week's Schedule – Used to show the current interactive Bell Schedule.
 - f. Audio Distribution – Used for entire facility or Audio Zones
 - g. Enable or Disable Audio – Used to place the Nyquist system into Page Exclusion mode (i.e., "mute" the system) when a contact closure is supplied from the fire alarm panel. Systems that do not provide this capability are deemed not equal.

Systems that require application software to be installed on a PC to manage the above features shall not be considered equivalent.

6. To facilitate installation and configuration of the system, additional Web UI menus are required. The menus shall only be visible to users with the correct roles and CoS. The navigation menus found on the Web UI shall be as follows:
 - a. System Parameters – Allow installers to adjust core system parameters.
 - b. Zones – Allow installers to create and modify Paging, Time, and Audio Zones.
 - c. Schedules – Allow installers and administrators to create bell schedules for the facility, predefine alternative schedules to run, prevent the bells from ringing on a holiday, and schedule an announcement to play. The system shall allow an unlimited number of schedules to operate simultaneously within a facility.
 - d. Admin Groups – Allow the installer to create, modify, and delete software groupings of admin phones that can ring when a station calls in with a call switch.
 - e. CoS Configuration – Allow the installer to create, modify, and delete CoS groups that control station access to the following features: Call-in Level, Zone Paging, All-Call Paging, Emergency All-Call, Inter-Facility Call/Page, Audio Distribution, Remote Pickup, Join Conversation, Call Forwarding, Walking Class of Service, External Call Routing, Call Transfer/3-way Calling, Manually Activate Tone Signals, Call Any Station, Manage Recording, Monitor Calls, Monitor Locations, Conference Admin, Conference User, Voicemail, Record Calls, Activate Alarm Signals, Disable Audio, Enable Audio, Allow Callee Auto-answer, District Paging, and Inter-Facility Features.
 - f. Stations – Allow the installer to set up, modify, and delete stations; set up Page Exclusion; view Station Status; and add New Stations.
 - g. Bridge Devices – Allow the installer to configure the Nyquist ASBs.

- h. Audio – Allow the installer to upload and manage Announcements, Playlists, Songs, and Tones. The system must support the uploading of both MP3 and WAV files and make Audio file management simple for users. Systems that limit the size of Audio files shall not be considered equal.
- i. Users – Allow the installer to manage users by giving them the proper roles and assign extensions if needed.
- j. Roles – Allow the installer to grant users rights to Create, Delete, Edit, Restart Server, Sort Menu, Systems Update, Manage, Import/Export, Restore, Settings, or View.
- k. Facilities – Allow the installer to set up the district wide facilities for remote paging and calling.
- l. Outside Lines – Allow the installer to set up FXS and FXO ports for inbound and outbound system calling.
- m. SIP Trunks – Allow the installer to set up SIP trunks into the facility for inbound or outbound calling.
- n. Call Details – Allow the installer to review the historical system activities that can be used for incident investigation or system troubleshooting.
- o. System Backup/Restore – Allow the installer to preform system backups or restores and allow the backups to be schedule to run automatically.
- p. System Logs – Allow the installer to view and export Server, Nyquist-Intercom, and Web Server logs that can be used for troubleshooting and technical assistance.
- q. Paging Exclusions – Allow the installer to view and edit stations that are excluded from paging.
- r. Firmware – Update firmware for Nyquist speakers and appliances.
- s. Help – Provide information about the system, online help topics, and System Administrator Manual.

Systems that do not provide these menus as a minimum shall not be considered equal.

C. Nyquist NQ-E7030 Analog Station Bridge (ASB)

- 1. The Nyquist NQ-E7030 ASB allows facilities with existing compatible intercom systems to upgrade to Nyquist. Each ASB supports up to 24 speakers and call switches with 120 Watts of embedded 25 Volt power. The ASB is designed to drive any combination of 25 Volt speakers and horns. Features Include:
 - a. 10/100 Ethernet
 - b. 24 station interface - Supports connections to as many as 24 individual 25 Volt speakers with one 25 Volt speaker connection per interface
 - c. 24 dry contact closure-type analog Call Switch connections
 - d. Half-duplex talkback using speaker as pickup
 - e. CAN Bus 2.0 Interface for future NQ-E7020 DCS support and other accessory devices
 - f. 120W of available power across all 24 channels; maximum 40W per channel
 - g. 2 x RGB full spectrum LED status indicators
 - h. USB 2.0 host port, type A connector (future use)
 - i. Universal mains supply (100VAC – 240VAC)
 - j. Provide 15 ASB's. Turn over any extra ASB's that are not needed at this time to the Owner for spare stock.

2. The Nyquist NQ-E7030 ASB shall be rack, wall, or shelf mountable and shall include the required mounting bracket hardware.
- D. Nyquist NQ-P0100 Matrix Mixer Pre-Amplifier (MMPA)
1. The Nyquist NQ-P0100 MMPA is designed to bring external audio into the Nyquist system. The MMPA interfaces with a local sound system by accepting one or more local audio sources, mixing them, and outputting them to either, a) the network for Audio Distribution, or b) the MMPA's line level output that can then be inserted into an external amplifier to drive local sound system in gyms, cafeterias, auditoriums, etc. The MMPA supports the following:
 - a. Four software selectable MIC or Line Input channels via three XLR connectors and four sets of screw-terminals. Any single input channel shall be capable of being configured to support a Push-to-Talk microphone (for example, Bogen DDU-250). Channel-1 can be configured as a digital AES/EBU (AES3) input. Line/Monitor output – The MMPA becomes a station on the Nyquist system, allowing users to call it directly or to include it in any of the Page, Time, or Audio Zones.
 - b. The MMPA shall support the following features: Line-Level output to drive input on a local amplifier; One USB 2.0 host port (Type-A connector) for future use; 2 x RGB full spectrum LED status indicators.
 - c. The MMPA is powered by Universal mains supply (100VAC – 240VAC).
 - d. The MMPA shall be wall or shelf mountable and shall include the required mounting bracket hardware.
 2. The dealer shall supply a minimum of one Nyquist MMPA that allows for up to four user-configurable audio inputs. The MMPA shall support Line, MIC, and digital AES/EBU (AES3) input sources. The system shall support an unlimited number of MMPAs.
- E. Nyquist NQ-E7010 Input/Output Controller
1. The Nyquist NQ-E7010 I/O Controller is designed to accept contact closure inputs and activate open-collector outputs to drive relay coils.
 - a. PoE Class-1; IEEE 802.3af compliant with Optional 48VDC 15W power supply
 - b. Eight Dry Contact Closure Inputs that can be used with Fire Alarm Override Relays, external event triggers (for example, Lockdown Buttons, etc.)
 - c. Eight Relay Driver Outputs (Open-Collector) for use with Clock Correction (Sync Pulse), response to contact closure inputs, etc.
 - d. USB 2.0 host port, Type-A connector (future use)
 - e. 2 x RGB full spectrum LED status indicators
 2. The Nyquist NQ-E7010 I/O Controller shall support wall or shelf-mounting options and shall include the required mounting bracket hardware.
 3. The Nyquist NQ-E7010 I/O Controller shall be designed for wall or shelf mounting.
- F. Nyquist VoIP Admin Phone – Color Touch Display (Admin Station)
1. The Nyquist Admin Station shall have the following features:

- a. 7" 800 x 480-pixel color display with backlight
 - b. Touch screen display for one touch operation
 - c. Full-duplex hands-free speakerphone with AEC
 - d. Call hold, mute
 - e. Redial, call return, auto answer
 - f. PoE (802.3af) Class-3 support
 - g. Headset with EHS support
 - h. Dual Gigabit Ethernet ports
 - i. Desk Mountable
 - j. Optional Wall mount capable
 2. The Nyquist Admin Station display panel shall show the time of day and day of week, the current bell schedule(s), and the station numbers and call-in priority of staff stations that are calling in. Depending upon the system programming, an Admin Station shall display menus to activate Zone Paging, All-Call Paging, Emergency All-Call Paging, District All-Call paging, alarm signals, and external functions.
 3. The Admin Station shall be capable of calling either the loudspeaker or Staff Station at each classroom location.
 - a. The Admin Station shall display the classroom number of any station that calls 911. This allows front-office administrators to direct emergency personnel to the correct physical location in the building when they arrive. If a system is not connected to outside phone lines, then 911 calls can be routed to a designated station within the facility. The system shall automatically record all 911 calls made from any station. The 911 call recording shall begin as soon as 911 is dialed and continue until the call is terminated. Recorded calls shall be maintained on the system for later playback review and/or retrieval by authorized personnel and/or authorities. Systems that do not provide this feature will not be deemed equal.
- G. Nyquist NQ-T1000 Staff VoIP Phone – LCD Display (Staff Station)
1. Not applicable to this project.
- H. Nyquist NQ-S1810CT VoIP Ceiling Speaker with Talkback and NQ-S1810WT VoIP Wall Baffle Speaker with Talkback
1. Not applicable to this project. Existing analog speakers shall remain and be connected into the new Bogen Nyquist system via analog-to-digital switches.
- I. Nyquist NQ-E7020 Digital Call Switch
1. Not applicable to this project.
- J. Bogen Analog Call Switch CA-15C
1. The momentary Call Switch shall be capable of placing a combination of Normal/Urgent/Emergency Calls based on the software configuration of the Call Switch.
 2. Normal/Emergency call configuration: Making a Normal call in this mode involves pressing the button on the Call Switch once. A call is then placed to the designated Admin Station. An Emergency call involves pressing the call switch at least four times. The Emergency call is then routed to the designated Admin Station. In both scenarios, the

- calling station number and call-in level (Normal or Emergency) are displayed on the Admin Station or on a group of Admin Stations. Additionally, Emergency calls can be routed to an alternative Admin Station or Emergency Link.
3. Urgent/Emergency call configuration: Making an Urgent call in this mode involves pressing the button on the Call Switch once. A call is then placed to the designated Admin Station. An Emergency call involves pressing the button on the Call Switch at least four times. The Emergency call is then routed to the designated Admin Station. In both scenarios, the calling station number and call-in level (Urgent or Emergency) are displayed on the Admin Station or on a group of Admin Stations. Additionally, Emergency calls can be routed to an alternative Admin Station or Emergency Link.
 4. Emergency Only call configuration: Making an Emergency call in this mode involves pressing the Emergency call switch with Call Level Emergency one time. The call is then switched to the Admin Station. This requires the display of the station number and call-in level on the Admin Station or on a group of Admin Stations. Additionally, Emergency calls can be routed to any Admin Station, including Emergency Link.
 5. Emergency Link Transfer - If an Emergency call goes unanswered by the Admin Station and the Emergency link transfer is active, the Emergency call will be forwarded to the loudspeaker associated with the Emergency Link Station. Any station equipped with a loudspeaker can be programmed as the Emergency Link Transfer. Systems that do not provide Emergency Link Transfer shall not be considered equal.
 6. In addition to the mechanical click of a Call Switch button press, a call confirmation audio file shall be played on the associated loudspeaker when a call is placed. The three call-in levels shall have distinct audio confirmation messages:
 - a. Call Placed
 - b. Urgent Call Placed
 - c. Emergency Call Placed
 7. Provide 90 call-in switches. Install call-in switches in every location on campus that has an existing call-in switch. Turn over any extra switches to the Owner for spare stock.

K. Additional Loudspeakers for use with the Nyquist ASB

1. Classroom Speakers shall be Bogen: Not applicable to this project.
2. Hallway Speakers shall be Bogen: Not applicable to this project.
3. Gym/Locker Room Speakers shall be Bogen: Not applicable to this project.
4. Outdoor Speakers shall be Bogen:
 - a. Exterior Wall Mounted Speakers shall be bi-directional reentrant horn loudspeakers, outdoor weatherproof type with metal alloy speaker cones, fully sealed driver cabinet, cast aluminum basket, and terminal boot for connection protection. The aiming direction of each of the two horns shall be field adjustable. Mounting brackets shall be stainless steel. Color shall be selected beige. Speakers shall be Bogen Model BDT30A or approved equal.
 - b. Provide amplifier for exterior speakers and other non-IP type speakers. Separate amplifier shall be provided for the exterior speakers, and this amplifier (or amplifiers) shall be set up for shut-down at night and after hours when the pages do not want to be heard in the exterior areas. All exterior speakers shall have the volume adjusted in the

presence of the Owner until the Owner is satisfied with the volume level in each exterior area. Adjust the wattage taps as necessary.

4. Common Area Speakers shall be Bogen:

- a. Not applicable to this project.

L. Where indicated on the drawings, provide a minimum 1500 VA, rack mounted UPS for back-up power for the IP intercom system at each building. Provide floor mounted where indicated. APC or Tripp-Lite only.

M. Offices

1. Offices, such as Principal, Assistant Principal, etc. (any office without a call-in station) shall be set-up and programmed to use their VoIP phone system handset. Provide all required materials and labor to connect the IP intercom into the school VoIP phone system and set-up all authorized access for incoming and outgoing calls.

2.4 MASTER CLOCK

A. BCMA 3000 Master NTP/SNTP Server / Master Clock

The NTP/SNTP Server / Master Clock shall be the Bogen BCMA 3000 Series. The master clock shall have a LED display, as well as a backlit, two row by twenty character LCD display. The master clock shall have up to ten pre-programmed NTP/SNTP servers to use in case the clock does not receive time from one of the servers via a web interface. The master clock will be capable of receiving signals from all Bogen Master Clocks via RS485, as well as 59 minute correction. The master clock shall be provided with the ability of transferring a wired system into a wireless system (with transmitter option). The master clock shall be powered by 110VAC/60 Hz or 220VAC/50 Hz.

Master clock and server shall be an integrated system with the Bogen E7000 Nyquist intercom system. One master clock and one server may be utilized where possible for one integrated system.

1. Master Clock server shall be Bogen BCMA-3R30-1100-1.
2. Provide the following BCMA 3000 upgrades
 - a. Relays (zones) - The master clock shall be capable of utilizing four or eight zones that can be used for bell scheduling, lights, etc. The zones shall be capable of being programmed via the 16 button rubber tactile keypad and LCD display.
 - b. Transmitter - The transmitter shall transmit data to the BCAL wireless analog clock and the BCBL wireless digital clock. The master clock shall be capable of receiving a signal from any SNTP time server via the Internet. The transmitter shall utilize 915–928 MHz frequency–hopping technology. The master clock shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main master clock.
 - c. GPS – The master clock shall have the option of having a GPS receiver built into the unit for synchronization from the satellites via UTC.
 - d. Web Interface – The master clock shall be able to be programmed completely from a web interface that can be accessed through any typical web browser such as

Microsoft Internet Explorer or Mozilla FireFox. The interface shall allow the user to program all bell schedules, events, display features, IP settings of the master clock and any system setting that the master clock has.

- e. NTP/SNTP Server – The master clock shall have the capability to act as a SNTP server that other devices can point to in order to receive the time through SNTP protocol.
- f. Countdown for Digital Clocks – The master clock shall be able to set the countdown time between events and have the digital clocks count down

2.5 ANALOG CLOCK

- A. The secondary clock shall be Bogen BCAL Series wireless, 900 MHz, analog clock, 12” round, with sweep hour, minute, and second hands. The clock shall utilize battery power. Provide batteries for all clocks. The clock shall be able to receive time from up to 10 SNTP or NTP time servers. The clock shall be able to perform diagnostics to determine when it last received communication, as well as a mechanical test of the clock itself. The secondary clock is to have a microprocessor based movement. The clock shall have a low-profile, semi-flush smooth surface metal case. The crystal will be shatterproof polycarbonate material. Glass and visible molding marks are unacceptable. The clock is to have black hour and minute hands, as well as a red second hand. Provide 160 clocks. Install clocks in every location on campus that has an existing clock. Install any extra clocks in locations as directed by the Owner or turn over to the Owner for spare stock.

- 1. Clocks shall be Bogen BCAL-4BS-12R-0

2.6 DIGITAL CLOCK (NON-CLASSROOM AREAS)

- A. Not applicable.

2.7 SYSTEM CAPABILITIES

- A. The communication system shall be a Bogen Nyquist E7000 Series Educational System and shall provide a comprehensive communications network between administrative areas and staff locations throughout the facility.

The system shall provide no less than the following features and functions:

- 1. Software-based, state-of-the-art, Voice over IP (VoIP) paging and intercom solution.
- 2. The system shall provide a Web User Interface (Web UI) shall allow users to configure and control the system, in accordance with their assigned User Role, from any Web browser enabled PC, Mac, Android or iOS tablet or mobile device.
- 3. Amplified-voice communication with analog loudspeakers shall use a shielded audio pair when connected to an ASB.
- 4. The system shall support any combination of the following VoIP phone station types:
NQ-T1100 Administrative VoIP Phone – Color Touch Display (Admin Station) or NQ-T1000 Staff VoIP Phone – LCD Display (Staff Station).

- a. All VoIP phone station types shall utilize the same type of field wiring.
 - b. There shall be no limit to the number of Admin Stations that can be connected to a facility. Systems that require different head-end equipment to make Admin Stations function, or systems that limit the number of Admin or Staff Stations shall not be deemed acceptable.
5. Future station alterations shall only require the Station Type to be changed in system programming. Alterations shall not require field wiring or system head-end alterations, unless an analog station device is being replaced by a VoIP station device or vice-versa.
6. The system shall be a global non-blocking system. The system shall be capable of unlimited amplified intercom paths per facility. Two amplified intercom paths shall be provided with each ASB for its complement of 24 stations. All hardware, etc., required to achieve the necessary number of amplified-voice intercom channels for this system shall be included in this submittal. ASB amplified-voice intercom channels shall provide voice-activated switching. Systems requiring the use of a push-to-talk switch on administrative telephones shall not be acceptable. There shall be an automatic level control for return speech during amplified-voice communications. The intercom amplifier shall also provide control over the voice switching sensitivity and delay times of the VOX circuitry on the ASB.
7. The system shall provide 911 Dial-Through via outside FXO/FXS lines or SIP trunks to ensure that one or more lines are always available for 911 calls. The 911 Dial-Through is available to any properly configured station (via CoS). When a station dials 911, the 911 call is processed as follows:
 - a. Call routes to an Emergency Group where the call can be answered.
 - b. The 911 CO lines can be pre-configured and reserved. If the 911 reserved lines are busy, the normal CO lines will be connected to route the 911 calls. If all the normal CO lines are busy, then one of the ongoing calls shall be disconnected and the 911 call shall be placed.
 - c. When 911 is dialed from any station, its designated Admin Station or Admin Group will receive a message that the station has dialed 911.
 - d. The system shall automatically record all 911 calls made from any station. The 911 call recording shall begin as soon as 911 is dialed and shall continue until the call is terminated. Recorded calls shall be maintained on the system for later playback review and/or retrieval by authorized personnel and/or authorities.
8. It is of highest importance that Emergency calls from stations receive prompt attention. Therefore, it is important that there be an alternative destination in case the Emergency call does not get answered at the primary location. Details are as follows:
 - a. Staff-generated Emergency calls shall be treated as the second highest system priority. Therefore, all Emergency calls shall annunciate at the top of the call queue of their respective Admin Station or Admin Group. Should that Emergency call go unanswered for 15 seconds, the call shall be re-routed to an alternative speaker station. Then, a tone will prompt the caller to make a verbal call for help and annunciates to the Emergency link station "Emergency." During the transfer, the original administrative telephone shall continue to ring the distinctive Emergency Ring. Should the Emergency Transfer-to-Station have an associated Admin Station, it will also ring for the Emergency call.
 - b. The Emergency Transfer-to-Station shall be software configurable.

- c. Systems failing to transfer unanswered Emergency calls or failing to immediately connect to the designated Admin Station shall not be deemed as equal.
9. There shall be a Facility Wide Emergency All-Call feature. The Emergency All-Call shall be accessed from designated Admin Stations or the Nyquist Dashboard or by the activation of an external contact closure that shall give a microphone input Emergency status. The Emergency All-Call function shall have the highest system priority and shall override all other loudspeaker-related functions including Time Tones, Normal All-Call or Zone Pages, or Audio Distribution.
- a. Considering that Emergency calls are to be treated with the highest level of concern, systems that do not regard Emergency All-Call with the highest priority shall not be deemed as equal.
 - b. Upon touching the Directory icon, a menu shall appear on the Admin Station display prompting the user to select the desired menu.
 - c. The Emergency All-Call shall capture the highest-level system priority and shall be transmitted over all speakers in the facility. It shall also be capable of activating an external control output, which can be used to activate external relays to automatically override volume controls, local sound systems, or strobe circuits.
 - d. Systems without Emergency All-Call or systems with All-Call that cannot be activated by external means or that do not capture complete system priority or activate an external relay, shall not be acceptable.
10. There shall be unlimited Alarm Tones (four by default). Each may be accessed by dialing *91 and the two-digit tone number from any Admin Station, SIP Trunk, or FXO/FXS system interface. These Alarm Tones are separate from the Time Tones. Users shall be able to add an unlimited number of Alarm Tones to the system by uploading MP3 or WAV files. Systems that do not allow the user to upload MP3 and WAV files to customize the Alarm Tones or need to use external alarm/tone generators or special software or have less than four Emergency Alarm Tones shall not be acceptable.
11. Upon touching the Directory icon on an Admin Station, a menu shall appear on the display prompting the user to select from the sub-menus. The Alarms sub-menu is the first available. This precludes the user from having to memorize complicated key sequences to access Alarm Tones.
12. There shall be unlimited I/O Controller relay driver outputs accessible and controllable by properly authorized users via an Administrative Web UI. These outputs remain set until accessed and reset. Users shall have the ability to review the status of each relay driver output. Users shall be prompted through fields via a plain English menu, precluding users from having to remember any dialing sequences to control this feature. The system shall support an unlimited number of I/O Controllers, and each I/O Controller shall be able to interact with any and all other I/O Controllers on the system (i.e., an input on one I/O Controller can trigger an output on one or more different I/O Controllers). Systems that require the user to remember complicated dialing schemes or prompt the user via cryptic commands shall not be acceptable.
- a. The I/O Controller can create a contact closure when the following operations are performed in the system:
 - 1. 911 call placed
 - 2. Audio Distributed

3. Alarm is played
 4. Announcement is played
 5. All-Call preformed
 6. District All-Call performed
 7. District-Emergency-All-Call
 8. Emergency-Call
 9. Emergency-All-Call
 10. Audio-Disabled
 11. Page
13. The system shall provide software controlled and programmable control outputs for external relay activation for use with strobe lights, magnetic locks, card access systems, motion detectors, cameras, or any low-voltage, dry contact creating device. Systems using dedicated security stations for control of external functions shall not be acceptable.
 14. The system shall be capable of interfacing to PSTN/PBX/iPBX via both FXO/FXS line and SIP trunk connectivity.
 15. The system shall be capable of providing each facility (i.e., (i.e., Nyquist location) an unlimited number of incoming FXO/FXS or SIP trunk lines that can be designated by the user to ring the designated Day Admin or Night Admin. Where an Admin Station is designated to receive outside line calls, the incoming call's Caller ID information shall appear on the display. The system shall also provide the ability to make outside line calls from Admin Stations. This ability shall be programmable for each Admin Station and there shall be an unlimited number of CoSs available to assign to any station.
 16. The system shall be capable of supporting DID, DISA, and Security DISA functions.
 - a. The system shall provide a password-protected Security DISA feature that shall only be accessible from authorized Police, Fire, Emergency personnel, or an off-premise security office that monitors the facility's security system. The Security DISA feature shall function as follows: Upon dialing the Security DISA phone number, the caller will receive a dial tone from the system, after which he or she must enter the assigned Security DISA passcode on the dial pad. Upon confirmation, the system will present the dial tone again and will allow the authorized personnel to dial any station/classroom on the system and monitor the activity without any pre-announce tone or privacy beep. This will allow the authorized personnel to audibly assess the situation and determine what actions need to be taken.
 - b. All DISA and Security DISA calls shall be automatically recorded by the system for later playback review and/or retrieval by authorized personnel and/or authorities.
 17. The system shall provide for field-programmable three-, four-, five-, or six-digit architectural station numbers.
 18. There shall be an automatic level control for return speech during amplified-voice communications.
 19. Each station loudspeaker shall be assignable to all or any combination of Paging, Time, and/or Audio Zones. Systems that do not provide unlimited Paging, Time, and/or Audio Zones shall not be acceptable.
 20. There shall be unlimited schedules with unlimited programmable events per facility. Each event shall sound one user-selected tone or external audio source. It shall be possible to assign each schedule to a day of the week or to manually change schedules from an authorized user via a web-based UI. Systems that do not provide unlimited schedules,

events, and tones, or that require software to be installed on a PC to perform these functions shall not be acceptable.

- a. The system shall provide multiple concurrent schedules per facility/location to accommodate split facilities (for example., combined Elementary and Middle School, combined Middle and High School, etc.).
 - b. The system must be capable of providing Class Change Music to be played from an external audio source or audio files that are stored in playlists on the system during class change periods or whenever a facility wants music to be played in an area (i.e., one or more Time Zones) on an automated schedule.
 - c. Each event shall be able to be directed to any one or more of the unlimited Time Zones.
 - d. Each of the unlimited Time Zones shall have a programmable, customizable Preannounce Tone and volume control that is unique unto itself.
 - e. Each event shall play any of the Normal tones or external audio. Each event may utilize a different tone. For example, the system shall be capable of sending the gymnasium, shop classes, and pool a separate, unique time tone to indicate "clean up." Minutes later, the entire facility can be sent a different time tone to indicate class change.
 - f. Each of the unlimited Time Tones may be manually activated by selected VoIP Admin Phones or via an authorized user with access to the Web UI. These tones shall remain active as long as the telephone remains off-hook or until canceled from the keypad or the Nyquist Web UI.
1. Systems that do not provide an unlimited number of schedules or do not provide automatic activation of schedules shall not be acceptable.
21. Internal Master Clock shall be included, allowing an unlimited number of events per facility. Systems that do not provide an internal master clock or that must supply an external master clock to meet these specifications shall not be acceptable.
 22. The Nyquist E7000 is capable of synchronizing with an NTP server and automatically adjusting the Daylight Savings Time for any time zone in the world. The server that the Nyquist E7000 application is running on can also be used as an NTP server for other systems on the LAN (for example, IP Clocks and control systems).
 23. There shall be a Zone Page/All-Call Page feature that is accessible by selected Admin Phones and FXO/FXS or SIP connection to the PSTN or PBX/iPBX.
 24. There shall be an option to play a pre-announce tone at any loudspeaker selected for voice paging.
 25. There shall be a voice-intercom feature that is accessible by CoS authorized staff phones, all Admin VoIP phones, and Admin Web UIs.
 - a. There shall be a privacy beep played every 15 seconds at any selected loudspeaker to indicate that an intercom call is in progress.
 - b. There shall be a pre-announce tone played at any selected loudspeaker for intercom call communication.
 - c. For special applications, the privacy and pre-announce tone signals shall be capable of being disabled during system initialization.
 - d. There shall be a switch over to private telephone communications should the person at the classroom loudspeaker pick up his or her Staff Station and dial *3 to transfer the call down to the associated classroom Staff Station.

26. There shall be various levels of telephonic communication accessible by all Admin Stations and Staff Stations.
 - a. Staff Stations must be capable of being programmed to ring one Admin Station during day hours and a different Admin Station during night hours. Day and Night start hours shall be configurable. Staff Stations shall be capable of being assigned to any Admin station. Systems that limit the number and assignment of staff calls to an Admin Station shall not be acceptable.
27. Each VoIP speaker or ASB speaker equipped with a call switch (analog or digital) shall be configurable as one of three call-in types, as follows:
 - a. Normal/Emergency
 - b. Urgent/Emergency
 - c. Emergency
28. Call buttons programmed for access Normal / Emergency or Urgent / Emergency shall be able to initiate an Emergency call by repeated flashing of the phone's hook switch, or repeated pressing of the DCS or the Call Switch. Systems that require additional switches and/or conductors to initiate an Emergency call, shall not be acceptable.
29. Normal and Urgent calls shall be placed into the queue for the designated Admin Station or Admin Web UI.
30. Each Admin Station call queue shall first be sorted per call priority (for example, Emergency, then Urgent, and then Normal). Calls are sorted within each priority level on a first-in, first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems that do not sort calls per priority and order received shall not be acceptable.
 - a. The display shall simultaneously display a minimum of three intercom calls pending.
 - b. Additional calls beyond three shall be indicated by a scrolling option on the right-hand side of the screen thus prompting the user that additional calls are waiting.
31. It shall be possible to answer any incoming call by picking up the handset while it is ringing. It shall not be necessary to press any buttons to answer a call unless the call has dropped into the queue.
32. Staff Stations
 - a. Staff Stations shall receive a dial tone upon going off-hook. Outgoing calls are made by dialing the desired station. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be a switchover from loudspeaker to private telephone communication when a person picks up the handset, dials *3, and presses Enter/OK.
 - b. Staff Stations shall be programmable for any type of system access, provided by or restricted by the following CoS options:
 1. Call-in Level
 2. Zone Paging
 3. All-Call Paging
 4. Emergency All-Call

5. Inter-Facility Call/Page
6. Audio Distribution
7. Remote Pickup
8. Join Conversation
9. Call Forwarding
10. Walking Class of Service
11. External Call Routing
12. Call Transfer/3-way Calling
13. Manually Activate Tone Signals
14. Call Any Station
15. Manage Recordings
16. Monitor Calls
17. Monitor Locations
18. Conference Admin
19. Conference User
20. Voicemail
21. Record Calls
22. Activate Alarm Signals
23. Disable Audio
24. Enable Audio
25. Allow Callee Auto-answer
26. District Paging
27. Inter-Facility Features
28. Manage Output Contacts

- c. Staff Stations shall be able to make a Normal call to any Admin Station by dialing the Admin Station's extension number. Staff Stations shall also be able to initiate an Emergency Call by dialing ****. Emergency Calls shall ring the Designated Day/Night Admin Station. The system shall provide for each station to have a Personal Identification Number (PIN). By dialing the PIN at any system telephone, the administrator shall have access to Emergency paging regardless of the restrictions on the particular phone being used.

33. Admin Stations

- a. Admin Stations shall receive a dial tone upon going off-hook. Outgoing calls are made by dialing the desired stations. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switchover from loudspeaker to private telephone communication should the person pick up his or her handset.
- b. The display shall normally show the time of day and day of week, bell schedule name, and the numbers of a minimum of three stations calling-in, along with the call-in status of each station (Normal, Urgent, Emergency). The Admin Station's display shall indicate the station number being dialed from the Admin Station.
- c. The display shall also provide user-friendly menu selections to assist the operator when using the Nyquist system. Displays shall be in English for maximum ease-of-use. Systems that require the operator to memorize long lists of operating symbols or control codes shall not be acceptable.
- d. Admin Stations shall be programmable for any type of system access, providing or restricting the following CoS options:

1. Call-in Level
 2. Zone Paging
 3. All-Call Paging
 4. Emergency All-Call
 5. Inter-Facility Call/Page
 6. Audio Distribution
 7. Remote Pickup
 8. Join Conversation
 9. Call Forwarding
 10. Walking Class of Service
 11. External Call Routing
 12. Call Transfer/3-way Calling
 13. Manually Activate Tone Signals
 14. Call Any Station
 15. Manage Recordings
 16. Monitor Calls
 17. Monitor Locations
 18. Conference Admin
 19. Conference User
 20. Voicemail
 21. Record Calls
 22. Activate Alarm Signals
 23. Disable Audio
 24. Enable Audio
 25. Allow Callee Auto-answer
 26. District Paging
 27. Inter-Facility Features
 28. Manage Output Contacts
- e. Program selection and its distribution or cancellation shall be accomplished from a designated Admin Station with the assistance of the menu display system. Distribution and cancellation shall be to any one or combination of speakers, any Audio Zone or Audio Zones, or All Zones. It shall be possible to provide an unlimited number of program channels for the user to pick from.
- f. It shall be possible via an Admin Station to manually initiate any of the unlimited Normal Tones or Emergency Tones. The Tones shall be separate and distinctly different from the Alarm Tones. The Tone selected shall be capable of being played one time, continuously until it is canceled, or until the administrative display phone is placed back on-hook.
- g. Each Admin Station shall maintain a unique queue of all stations calling that Admin VoIP phone.
34. FUTURE CAPABILITY: VoIP Wall Baffle and VoIP Ceiling Speakers shall be configurable as one of two station types: 1) VoIP Speaker Only, or 2) VoIP Speaker with DCS.
- a. The Bogen Nyquist VoIP speakers are powered via PoE. Use an 802.3af compliant PoE network switch port or PoE Injector to power these speakers. One PoE network switch port or PoE Injector is required per VoIP speaker.
 - b. VoIP speakers can be equipped with a DCS that can be programmed as a Normal/Emergency, Urgent/Emergency, or Emergency Only and shall be able to

- initiate an Emergency call by touching the DCS one, two, or three times depending on the CoS and current call state of the DCS. If the station is authorized for Privacy Mode, the users can touch and hold for 4 seconds to enable Privacy Mode or hold for four seconds to disable Privacy Mode. Systems that require mechanical, membrane, or an additional number of switches to initiate an Emergency call, shall not be acceptable.
- c. Emergency Calls from VoIP Speaker with DCS shall have priority over the Normal and Urgent calls in the queue on the Admin Stations and will show up at the top of the list. Systems that do not provide priority for Emergency Call shall not be acceptable.
 - d. Normal and Urgent calls shall be logged into queue for the designated Admin Stations.
 - 1. Admin Stations shall ring for when they receive a call, and then the call will be removed from the queue when the call is answered or when the Admin Queue times out (default is 30 minutes).
 - e. Each queue call shall first be sorted by call priority (Emergency, then Urgent, and then Normal). Calls are sorted within each priority level on a first-in, first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems that do not sort calls by priority and order received, shall not be acceptable. The display shall simultaneously show a minimum of three staff calls pending. Additional staff calls beyond three shall be indicated by an arrow pointing down thus prompting the Admin user that additional calls are waiting.
 - f. It shall be possible to answer any incoming call simply by picking up the handset while it is ringing. It shall not be necessary to hit any buttons to answer a call unless the call has dropped into the queue.
35. System programming shall be from an authorized Nyquist Admin User via any web browser. A valid username and password shall be required to gain access to the following programmable functions:
- a. System Parameters – Allow installers to adjust core system parameters.
 - b. Zones – Allow installers to create and modify Paging, Time, and Audio Zones.
 - c. Schedules – Allow installers and administrators to create Bell Schedules for the facility, predefine alternative schedules to run. Holiday Events prevent the bells from ringing on a school holiday. The system shall allow an unlimited number of schedules to operate simultaneous within a facility.
 - d. Admin Groups – Allow the installer to create, modify, and delete software groupings of admin phones that can ring when a station calls in with a call switch.
 - e. CoS Configuration – Allow the installer to create, modify, and delete CoS groups that can have the following features defined: Call in Level, Zone Paging, All-Call Paging, Emergency All-Call, Inter-Facility Call/Page, Audio Distribution, Remote Pickup, Join Conversation, Call Forwarding, Walking Class of Service, External Call Routing, Call Transfer/3-way Calling, Manually Activate Tone Signals, Call any Station, Manage Recording, Monitor Calls, Monitor Locations, Conference Admin, Conference User, Voicemail, Record Calls, Activate Alarm Signals, Disable Audio, Enable Audio, Allow Callee Auto-answer, District Paging, and Inter-Facility Features.
 - f. Stations – Allow the installer to set up, modify, delete stations, set up Page Exclusion, view stations' status, and add a station.

- g. Bridge Devices – Allow the installer to install the Nyquist ASBs.
- h. Audio – Allow the installer to upload and manage Announcements, Playlists, Announcements, Songs, and Tones. The must support the uploading of both MP3 and WAV files making Audio file management simple for users. Systems that limit the size of Audio files shall not be considered equal.
- i. Users – Allow the installer to manage users by giving them the proper Role and assign an Extension if needed.
- j. Roles – Allow the installer to limit user to the following: create, delete, edit, restart server, sort menu, systems update, manage, import/export, restore, settings, or view.
- k. Facilities – Allow the installer to set up the district wide facilities for remote paging and calling.
- l. Outside Line – allow the installer to set up FXS and FXO ports for inbound and outbound system calling.
- m. SIP Trunks – allow the installer to set up SIP trunks into the facility for inbound or outbound calling.
- n. Call Details – allow the installer to review the historical system activities that can be used for incident investigation or system troubleshooting.
- o. System Backup/Restore – allow the installer to preform system backup or restores and allow the backups to be schedule to run automatically.
- p. System Logs – allow the installer to view and export Server, Nyquist-Intercom, and Web Server logs that can be used for trouble shooting and technical assistance.
- q. Paging Exclusions – allow the installer to view and edit station that are excluded from paging.
- r. Firmware – is used to update Nyquist appliances.
- s. Help –Provides information about the system, online help topics, and System Administrator Manual.
- t. Systems not capable of supporting web-based configuration and control, or require plugins or dedicated application software, shall not be deemed as equal.
- u. Systems that require a Serial-to-Ethernet converter, or require additional application software on a PC for configuration and/or control shall not be deemed as equal.

36. Admin Group

- a. Admin Stations can be placed into Admin Groups, which are used if incoming calls are not answered by the assigned Admin Station or the Day or Night Admin associated with the Admin Station. Admin Groups act as an always answer feature by providing an alternate list of Admin Stations. If an incoming call is not answered by the assigned Admin Station within 30 seconds for normal calls or 15 seconds for emergency calls, all Admin Stations in the Admin Group will ring.
- b. If Call Forwarding is enabled at the Admin Station, Nyquist tries the forwarded extension. If that station does not answer or is busy, the call timeout is reduced to 15 seconds. After 15 seconds, the call rolls over to the Admin Group.
- c. If an Emergency level call receives no answer, the Admin Group will ring if the Day Admin or Night Admin does not answer.
- d. Admin Stations can be assigned to multiple Admin Groups. A Day or Night Admin can also be assigned to one or more Admin Groups.

37. Call Detail Reporting

- a. The Call Details feature allows the viewing and/or printing of detail records of every call in a facility in a call log format. Calls include scheduled announcements, paging, and internally and externally made or received telephone calls.
38. System Backup/Restore
- a. The system backup feature allows users with access to back up the system database, voicemail, and recordings.
 - b. The system restore allows users with access to perform a system restore of previously backed up database, voicemail, and/or recordings.
 - c. The installer also can set up an automatic backup that can be performed daily, weekly, or monthly.
39. System Log Files
- a. A log file records either events or messages that occur when software runs and is used when troubleshooting the system. The following parts of the Nyquist system generate log files:
 - 1. Server (This provides access to the Debian Linux OS server log files.)
 - 2. Intercom (This provides access to the Intercom application server log files.)
 - 3. Web Server (This provides access to the web server log files.)
 - b. From the web-based UI, system logs can be viewed directly or exported via download to a PC, Mac, or Android device and then copied to removable media or attached to an email to technical support.
40. Paging Exclusions
- a. For school testing and exams, the administrators shall be able to put stations into Page Exclusion mode. During this time, the stations will only receive Emergency All-Call pages – not music, tones, or All-Calls. Emergency pages will still be heard at the station even if that station is set to exclude paging.

2.6 NETWORK CONNECTIONS AND CABLING

- A. Provide all required Cat 6 cabling and connections to each ASB. Connect into existing patch panels but provide new, additional patch panels as required.
- B. Provide all required Cat 6 patch cords to connect the ASB ports into an ethernet switch.
- C. Provide all required fiber patch cords to connect any switches into the existing campus fiber backbone.
- D. In general the existing campus data network shall be utilized to integrate the new intercom system together as a campus-wide system.
- E. Label all wiring and all patch panel ports to identify all intercom stations.

- F. All existing and any new wiring shall be toned out and tested, and all wiring identified as to the source and station served.
- G. Provide surge protection (EDCO or DiTek) on each exterior cable that serves exterior speakers.

2.7 POWER-OVER-ETHERNET SWITCHES

- A. Existing switches will be utilized.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with the installer present, for compliance with requirements and other conditions affecting the performance of the Nyquist E7000 Series Educational System.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

- A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.
- B. As further qualification for bidding and participating in the work under this specification, the manufacturer's representative shall hold a valid C-10 Contractor's License issued by the Contractor's State License Board of [your state]. The manufacturer's representative shall have completed at least 10 projects of equal scope, giving satisfactory performance, and shall have been in the business of furnishing and installing sound systems of this type for at least five years. The manufacturer's representative shall be capable of being bonded to ensure the owner of performance and satisfactory service during the guarantee period.
- C. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state that the manufacturer guarantees service performance for the life of the equipment and that there will always be an authorized distributor assigned to service the area in which the system has been installed.
- D. The contractor shall furnish a letter from the manufacturer of the equipment. This letter shall certify that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible, and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of five years after final acceptance of the project by the owner.

3.3 DIVISION OF WORK

- A. While all work included under this specification is the complete responsibility of the contractor, the following division of actual work listed shall occur:
 - 1. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work, shall be furnished and installed completely by the electrical contractor.
 - 2. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative. The entire responsibility of the system, its operation, function, testing and complete maintenance for one year after final acceptance of the project by the owner, shall also be the responsibility of the manufacturer's authorized representative.

3.4 INSTALLATION

- A. The installation, adjustment, testing, and final connection of all conduit, wiring, boxes, cabinets, etc., shall conform to local electrical requirements and shall be sized and installed in accordance with the manufacturer's approved shop drawings.
- B. Low-voltage wiring may be run exposed above ceiling areas where they are easily accessible.
- C. The contractor shall install the new system at the location shown on the plans.
- D. All Call Switches shall be wall-mounted at existing locations.
- E. Admin Stations shall be desk mounted. Provide all programming and set up to set up the Admin phone for all calls, station/classroom calls, and all zoning (including exterior paging only, interior paging only, middle school paging only, individual building-by-building paging only, and more zones as directed by the Owner.
- F. Speaker and telephone lines run above ceiling and not in conduit shall be tie-wrapped to a ceiling joist with a maximum spacing of 8' between supports. No wires shall be laid on top of ceiling tile.
- G. Connect field cable to each Analog Speaker transformer using UL butt splices for #22 AWG wire.
- H. Contractor shall provide a minimum of eight hours of configuration and operational instruction to school personnel.
 - 1. Bogen Communications, Inc., shall provide online "How To" videos for instructing the teaching staff on how to operate the Teacher Dashboard aspect of the system.
- I. On the first school day following installation of the Nyquist System, the contractor shall provide a technician to stand by and assist in system operation.
- J. Mark and label all demarks IDF and MDF points with destination point numbers. Rooms with more than one outlet shall be marked XXX-1, XXX-2, XXX-3, etc. where XXX is the room number.

- K. No graphic room number shall exceed the sequence from 000001 through 899999.
 - 1. All outside speakers shall be on a separate Page Zone and Time Zone.
 - 2. All zones shall be laid out not to exceed 40 Watts (@25V) maximum per zone.
 - 3. All hallway speakers shall be tapped at 1 Watt (@25V) maximum.
 - 4. All outside horns shall be tapped at 3.75 Watts (@25V) maximum.
 - 5. All classroom speakers shall be tapped at ½ Watt (@25V) maximum.
 - 6. Large rooms, such as cafeterias, shall be tapped at 2 Watts (@25V) maximum.
- L. Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.
- M. Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T and B wire-ties, or hook and loop cable management. Edge protection material shall be installed on edges of holes, lips of ducts, or any other point where cables or harnesses cross a metallic edge.
- N. Cable identification: Cable conductors shall be color-coded and individual cables shall be individually identified. Each cable identification shall have a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.
- O. Shielding: Cable shielding shall be capable of being connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in the same manner as conductors.
- P. Provide complete "in service" instructions of system operation to school personnel. Assist in programming of telephone system.

3.3 GROUNDING

- A. The contractor shall provide equipment grounding connections for Integrated Telecommunications/Time/Audio/Media System as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to ensure permanent and effective grounds.
- B. The contractor shall provide ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- C. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.
- D. The contractor shall note on their drawings the type and locations of these protection devices and all wiring information.
- E. The contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

PART 4 - EXECUTION

4.1 DIVISION OF WORK

- A. All work included under this specification is the complete responsibility of the contractor.
 - 1. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed completely by a licensed electrical contractor. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative. The entire responsibility of the system, its operation, function, testing and complete maintenance for one (1) year after final acceptance of the project by the owner, shall also be the responsibility of the manufacturer's authorized representative.

4.2 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

- A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.
- B. As further qualification for bidding and participating in the work under this specification, the manufacturer's representative shall hold a valid C-10 Contractor's License issued by the Contractor's State License Board of Florida. The manufacturer's representative shall have completed at least ten (10) projects of equal scope, giving satisfactory performance and have been in the business of furnishing and installing sound systems of this type for at least five (5) years. The manufacturer's representative shall be capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.
- C. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed.
- D. The contractor shall furnish a letter from the manufacturer of the equipment, which certifies that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of five (5) years after final acceptance of the project by the owner.

4.3 INSTALLATION

- A. Provide a complete and operational installation. Provide all required equipment, devices, wiring, amplifiers, and additional options and accessories as required to meet all the requirements of these specifications and drawings. Provide all required set-up and programming.

- B. Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T & B "Ty-Rap" cable. Edge protection material shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.
- C. Cable identification: Cable conductors shall be color-coded and individual cables shall be individually identified. Each cable identification shall have a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.
- D. Shielding: Cable shielding shall be capable of being connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.
- E. Provide complete "in service" instructions of system operation to school personnel.
- F. Provide set-up and programming of VoIP telephone system with the IP intercom.

4.4 DOCUMENTATION

Provide the following with project closeout documents.

- A. Provide a printed copy of all field programming for all components in system.
- B. Provide two copies of all diagnostic software with copy of field program for each unit (on CD).
- C. Provide one copy of all service manuals, parts list, and internal wiring diagrams of each component of system.
- C. One copy of all field wiring runs, location, and end designation of system, as-built drawings.

END OF SECTION 27 51 23

SECTION 28 31 11 - FIRE ALARM AND SMOKE DETECTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Addressable, supervised fire alarm and smoke detection system. System shall be a voice evacuation type system. System shall be an integrated campus-wide system.

1.2 RELATED SECTIONS

- A. Section 26 0500: ELECTRICAL REQUIREMENTS

1.3 REFERENCES.

- A. NFPA 70 - National Electrical Code - 2017.
- B. NFPA 72 - National Fire Alarm Code - 2016.
- C. 7th Edition of the Florida Fire Prevention Code (2020) including NFPA 101 – Life Safety Code – Florida Specific Edition.
- D. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems
- E. 7th Edition of the Florida Building Code – 2020.
- F. Americans with Disabilities Act (ADA)

1.4 REGULATORY REQUIREMENTS AND APPROVALS

The system must have proper listing and/or approval from the following agencies:

- A. State Fire Marshall: State of Florida Uniform Fire Safety Rules and Standards.
- B. Underwriters Laboratories Inc. (UL):
 - 1. No. 50 Cabinets and Boxes, current edition
 - 2. No. 268 Smoke Detectors for Fire Protective Signaling Systems, current edition
 - 3. No. 864 Control Units for Fire Protective Signaling Systems, current edition
 - 4. No. 464 Audible Signaling Appliances.
 - 5. No. 38 Manually Actuated Signaling Boxes.
 - 6. No. 1481 Power supplies for Fire Protective Signaling Systems.
 - 7. No. 1971 Visual Indicating Appliances.
- C. Modular Labeling: The Fire Alarm Control Panel shall meet the Modular Listing requirements of Underwriters Laboratories Inc. To facilitate system changes and expansions, and to ensure that

all subassemblies have the proper listing, each subassembly of the FACP shall carry the appropriate UL modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts. Systems which do not include modular labeling may require return to the factory for modifications, and are not acceptable.

1.5 DESCRIPTION OF SYSTEM

- A. The system shall be both an addressable and supervised, microprocessor based fire alarm control system with transient protection on each circuit and walk-through test capability. Each component of the system shall be UL listed for its use. The system shall have a Dynamic LCD display and be connected to the a remote monitoring station for emergency notification. The system shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, printer, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.

1.6 SCOPE

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance with the specifications and drawings.
- B. Basic Performance:
 - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto an NFPA Class A signaling line circuit.
 - 2. Initiation device circuits shall be wired NFPA Class A.
 - 3. Indicating appliance circuits shall be wired Style Y (Class B).
 - 4. Digitized electronic signals shall employ check digits or multiple polling.
 - 5. A single ground or open on any system signaling line circuit, initiating device circuit, or indicating appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
 - 6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
 - 7. All point devices shall be tamper resistant and the control panel shall report trouble by plain language address for any device which is tampered with.
 - 8. System shall be installed in strict compliance with current ADA regulations.

C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

- 1. The System Alarm LED shall flash.
- 2. A local piezo-electric signal in the control panel shall sound. The system trouble signal shall be distinctly separate from the system alarm signal.
- 3. The 80-character LCD display shall indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises. This information shall be displayed in "plain language" which is acceptable to the Owner and shall not be coded.

4. History storage equipment shall log the information associated each new Fire Alarm Control Panel condition, along with time and date of occurrence, for dial-up down load capability for remote print out of history.
5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated. Specifically, if any device in a individual building is in alarm, the system shall activate all alarm indicating appliances in that respective building from which the alarm was initiated.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in smoke detection and fire alarm systems with five (5) years documented experience.
- B. Installer: Company specializing in smoke detection and fire alarm systems with five (5) years documented experience and certified by the Florida State Licensing Board as fire alarm installing contractor.
- C. The Contractor shall maintain a service department capable of responding within 24 hours for maintenance and minor services, and four hours for major outages.
- D. A supervisor shall be assigned to the project and shall have a minimum 3 years experience installing fire alarm systems and be on site while fire alarm work is being performed.
- E. The fire alarm contractor shall be certified by the State of Florida with a current alarm contractor 1 license. The installation shall be supervised by an employee of the contractor who is qualified and has one of the following certifications: Alarm Contractor License 1; or an American Society of Industrial Security (ASIS) Certification. Copies of certifications for both the Company and the supervising installer shall be submitted with the project submittals and shall be approved prior to the commencement of work.

1.8 SUBMITTALS

- A. Submit six (6) copies shop drawings and product data, including detailed cut sheets on all equipment and devices, including control panel, batteries, power supplies, and all system devices.
- B. Provide complete point to point wiring diagrams, data sheets, and equipment ratings, layout, dimensions, and finishes. Wiring diagrams shall indicate wire sizes and types. Submit cut sheets on wire types.
- C. Submit manufacturer's installation instructions.
- D. Submit manufacturer's certificate that the system meets or exceeds specified requirements - certification per NFPA 72.
- E. Submit copy of Contractor's license before work begins.
- F. Submit battery calculations, indicating a 30% spare capacity. Battery calculations shall be submitted with shop drawings with point to point wiring indicated.

- G. Submit voltage drop calculations for indicating appliance circuits if required by the local fire marshal.
- H. Submit power supply and indicating circuit appliance load calculations, including the separate strobe circuit.
- I. Submit amplifier load calculations using a 1 watt load per speaker. This shall provide for spare capacity the amplifiers and allow for field adjustments.
- J. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.9 PROJECT RECORD DRAWINGS

- A. Contractor shall provide five (5) sets of As-built drawings produced in AutoCAD and all .DWG files, plus PDF files, on CD to the Owner upon completion of project.
- B. As-builts shall include the location of end-of-line devices and exact conduit and wire routing. Numbers and types of conductors shall be indicated for each circuit.
- C. Provide all point addresses and device descriptions on the record drawings.

1.10 OPERATION AND MAINTENANCE DATA

- A. Provide two (2) copies of operation and maintenance data prior to beginning construction for all point devices, CPUs, and all other equipment. Manuals shall be in 3" three ring binders with plastic pocket holders and red in color.
- B. Include operating instructions, and maintenance and repair procedures. Provide all proprietary information and a copy of installation instructions for each device in each set of manuals.
- C. Provide manufacturer representative's letter stating that system is operational.
- D. Provide as-built drawings complete with point numbers, junction box locations conduit and circuit routing.
- E. Spec sheets on each system component, including operational data.
- F. Schematic diagrams for each control panel and other devices.
- G. Complete Parts list.
- H. Maintenance procedures for each component.
- I. Maintenance schedule indicating factory recommended maintenance periods.
- J. Name, phone number and address of the installing fire alarm contractor, as well as the nearest factory authorized representative.

- K. System operating instructions and procedures sufficient to instruct owner's representative in operation of the system.
- L. All system certifications, warranty statements and other agreements.
- M. Any other information pertinent to the maintenance and repair of the system.

1.11 SPARE PARTS

- A. All spare parts shall be directly interchangeable with the corresponding components of the installed systems.
- B. The fire alarm contractor shall furnish a listing, in duplicate, of all spare parts and accessories that the manufacturer recommends to be stocked for proper maintenance of the system.
- C. Furnish (2) copies of list of manufacturer's recommended spare parts.
- D. Furnish the following spare parts:
 - 1. (1) Manual pull stations.
 - 2. (1) Smoke detectors and bases.
 - 3. (1) Duct smoke detector with housing.
 - 4. (2) Monitor modules.
 - 5. (2) 75cd strobes.
 - 6. (1) 110cd strobes.
 - 7. (2) Ceiling mounted speakers
 - 8. (2) Control modules.
 - 9. (2) Heat Detectors
 - 10. (3) Keys for each type of lock.

1.12 SOFTWARE

- A. The manufacturer, or authorized distributor, must maintain software version records on the system installed. The system software shall be upgraded free of any charge if a new version is released during the warranty period. For new version to correct operating problems, free upgrade shall apply during the entire life of the system. Provide read only software to District Maintenance Management with operation and maintenance manuals. Provide a copy of the program inside the FACP on site.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Products shall be delivered to job site in manufacturers original shipping packages.
- B. Provide storage and protection of products, as needed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Notifier NFS2 Series
- B. System shall be provided complete with voice command stations and associated annunciator.
- F. Specification and model numbers, where given, reflect Notifier devices.

NOTE : Approval of manufacturer's equipment does not in any way relieve the Contractor from meeting the performance criteria as outlined in the Plans and Specifications.

2.2 MAIN FIRE ALARM CONTROL PANEL:

- A. The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with, supervise and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator terminals, printers, annunciators, and other system controlled devices.

The fire alarm system shall utilize node-to-node, direct fiber connected multi-priority peer-to-peer network operations. All network wiring shall be fiber optic cable. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, annunciators, and workstations. Each node is an equal, active functional node of the network, which is capable of stand-alone decision making and generating network tasks to other nodes in the even of a node failure or fiber communications failure between nodes. The network fiber shall be connected in a Class A configuration, a single break on the network fiber isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined data bases. Should multiple fiber connections fail, the network shall re-configure into many sub-networks and continue to respond to alarm events from every panel that can transmit and receive network messages. Fire alarm fiber optic cabling shall be dedicated to the fire alarm system and be independent from the campus data network.

The main FACP shall perform the following functions:

1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to monitor and control modules.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
4. Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminals, panel display, and annunciators.
5. The FACP shall be UL listed for compatibility with a security system.
6. Provide a graphic display at the FACP which indicates each device location and address. This can be a copy of the as-drawings folded and attached to the FACP.
7. System shall be a complete voice evacuation type system, capable of live and pre-recorded messages.
8. Audio Annunciation and Control

- a. Provide a master one-way emergency audio control unit as part of the main alarm control panel. The emergency audio control shall contain a paging microphone and shall be capable of generating and delivering multi-channel audio messages simultaneously over copper and/or fiber media to remote parts of the facility. The main audio control unit shall be located in the main reception office area.
- b. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store up to 32 minutes of pre-recorded audio messages digitally as WAV files. These messages shall be automatically directed to various areas in a facility under program control. The unit shall have the capacity to store up to 200 individual audio messages and to simultaneously play back seven (7) different messages in addition to live page message.
 - 1) Consult the Owner prior to programming the messages for the exact, desired message content.
- c. During non-alarm conditions, the control unit shall continuously distribute a default audio message to all amplifiers, providing total audio path supervision. To enhance system survivability, each remote FACP cabinet containing an amplifier shall play the default audio message in the event of a fire AND a control network system failure.
- d. The one-way emergency audio control shall provide control switches to direct live paging messages as follows:
 - aa. "All Call" to direct the page messages to all areas in the facility, overriding all other messages and tones.
 - bb. "Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
 - cc. "Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones.
 - dd. "Page to Balance Building" to direct page messages to the areas in the facility NOT receiving either the evacuation area or alert area messages.
- e. The system shall automatically deliver a preannounce tone of 1000 Hz for three seconds when the emergency operator presses the microphone PTT key. A 'ready to page' LED shall flash during the preannounce phase, and turn steady when the system is ready for the user's page delivery. The system shall include a page deactivation timer which activates for 3 seconds when the emergency user release the microphone talk key. Should the user subsequently press the microphone key during the deactivation period a page can be delivered immediately. Should the timer complete its cycle the system shall automatically restore emergency signaling and any subsequent paging will be preceded by the pre-announce tone. A VU display shall indicate voice level to the emergency operator.
- f. The one-way audio control unit shall be capable of supporting up to 64 remote microphone inputs and a line level audio input.
- g. The fire alarm control panels shall support remote cabinets with zoned amplifiers to receive, amplify and distribute messages through speakers over supervised circuits.
- h. The master one-way emergency audio control unit shall be by Notifier/Honeywell, DVC Series.
- i. Each building shall be provided with a stand-alone fire alarm control panel with a voice evacuation command center and complete annunciation. The "building" fire alarm control panel may use a separate voice command control panel with microphone, or voice command control function may be integral with the building control panel. The campus fiber backbone communications shall be Class A and a

redundant direction if one fiber path is damaged or fails. As a minimum, command stations shall be provided with microphone and be capable of initiating live and pre-recorded messages. Voice command stations shall also be provided with full annunciation of all alarms, troubles, and supervisory conditions, and provide for alarm silencing.

- J, Voice communications shall incorporate one way communications and tone generating, with true digital integrated audio into the peer-to-peer fiber network, multiplexing 8 independent audio channels. The system shall include distributed audio amplifiers, minimum one for each speaker circuit, for system survivability. The channels if simultaneous audio for fire alarm activation shall be programmed as follows:

Channel 1:	Mass Notification Message (highest priority)
Channel 2:	Fire Alarm Message
Channel 3:	Alert Message
Channel 4:	Stand-by Message
Channel 5:	Weather Message
Channel 6:	Spare (future use)
Channel 7:	Telephone Input Paging
Channel 8:	Manual Paging

B. System Capacity and General Operation

1. The control panel shall provide, or be capable of expansion to 198 intelligent/addressable devices per loop plus 2048 annunciation points per system.
2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, and an alphanumeric keypad for the Field Programming and Control of the Fire Alarm System.
3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
4. The FACP shall be able to provide the following features:
 - a. Block Acknowledge.
 - b. Control-By-Time.
 - c. Device Blink Control.
 - d. NFPA 72 Sensitivity Test.
 - e. Alarm Verification.
 - f. CRT Display Interface.
 - g. Periodic Detector Test.
 - h. Upload/Download to PC Computer.
 - i. Verification Counters.
 - j. Maintenance Alert.
 - Charger Rate Control.
 - Day/Night Sensitivity.
 - Drift Compensation.
 - System Status Reports.
 - Printer Interface. Include printer either integral with the panel or stand alone. Provide printer stand and two boxes of printer paper. S-232 serial port.
 - Non-Alarm Module Reporting.
 - Trouble Reminder.
 - Walk Test.
 - Security Monitor Points.

C. Central Processing Unit

1. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the System Display by the Central Processing Unit.
2. The Central Processing Unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The Central Processing Unit shall also provide a real-time clock for time annotation of all system displays. The Time-of-Day and date shall not be lost if system primary and secondary power supplies fail.

D. Display

1. The System Display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The Display Assembly shall contain, and display as required, custom alphanumeric labels for all Intelligent Detectors, Addressable Modules, and Software zones. Include point address display for each.
3. The System Display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.
4. The System Display shall provide a 25-key touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels will be accessible through the Display Interface Assembly to prevent unauthorized system control or programming.
5. The System Display shall include the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE.

E. Loop Interface Board

1. Loop Interface Boards shall be provided to monitor and control each of the Signaling Line Circuit (SLC) Loops in the system. The Loop Interface Board shall contain its own microprocessor, and shall be capable of operating in Local Mode in the case of a failure in the Main CPU of the Control Panel.
2. The Loop Interface Board shall not require any jumper cuts or address switch settings to initialize SLC Loop operations.
3. The Loop Interface Board shall provide power to, and communicate with, all of the Intelligent/Addressable Detectors and Addressable Modules connected to its SLC Loop over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7. Provide a minimum of 2 SLC interface circuits.
4. The Loop Interface Board shall be able to drive 2 Style 4 runs of these SLC Loops, each up to 10,000 feet in length, for an effective Loop span of 20,000 feet.
5. The Loop Interface Board shall receive analog information from all Intelligent Detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The Loop Interface Board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

6. The Loop Interface Board shall communicate with up to 198 Intelligent/Addressable Detectors and Addressable Modules on its SLC loop and verify proper device function and status.

F. Serial Interface Board

1. The Serial Interface Board shall provide the EIA-232 interfaces between the Fire Alarm Control Panel and the UL Listed Electronic Data Processing (EDP) peripherals.
2. The Serial Interface Board shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.
3. The Serial Interface Board shall provide one EIA-485 port for the serial connection of the optional Annunciator and Control Subsystem components.
4. The Serial Interface Board shall have LEDs that will show that it is in regular communication with the Annunciators or other EIA485 connected peripheral device.
5. All EIA-232 serial output circuits shall be optically isolated.

G. Enclosures:

1. The control panels shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The control panel shall have a sheet of lexan mechanically fastened to the front of the entire panel such that all functions are still accessible.
2. The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top.
3. All fire alarm equipment locks shall be keyed alike.
3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable).
4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

H. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable. An external programmer may be used for the initial set-up but shall not be required for programming changes.

I. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

J. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used should employ dual transmission or other equivalent error checking techniques.

K. Power Supply:

1. The Main Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP. Circuit shall be a dedicated circuit.
2. It shall provide a minimum of 3.0 amps of usable indicating appliance power, using a switching 24 VDC regulator. The power supply shall be sufficient to supply the required

power for a minimum the entire building in alarm simultaneously, plus simultaneously provide continuous monitoring, supervision and annunciation of the remainder of the building.

3. It shall be expandable for additional indicating appliance power in 3.0 ampere steps. Provide one spare 3 ampere step in the current installation for future use. Also provide 2 extra circuits in each NAC panel in the system.
4. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
5. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.
6. It shall be power-limited using Positive Temperature Coefficient (PTC) resistors.
7. It shall provide meters to indicate battery voltage and charging current.
8. Provide all required power supplies at each fire alarm terminal cabinet at each building. Power supplies shall be installed in a separate lockable cabinet.

L. System Circuit Supervision:

1. The FACP shall supervise all circuits to intelligent devices, annunciators and conventional peripherals and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate that device or devices are not responding and print the information on the printer.
2. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.

M. Field Wiring Terminal Blocks

1. For ease of service all wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks that are not permanently fixed or mounted are not acceptable. Mount terminal blocks inside the fire alarm terminal cabinets. Wire nuts are not acceptable.

N. Operators Terminal: Provide the following functions in addition to any other functions required for the system.

1. Acknowledge (ACK/STEP) Switch:
 - a. Activation of the control panel Acknowledge switch in response to a single new Alarm and/or Trouble condition shall silence the local panel piezo electric signal and change the System Alarm or Trouble LED from flashing mode to steady-ON mode. If additional new Alarm or Trouble conditions exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next Alarm or Trouble condition.
 - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Signal Silence Switch.
 - a. Activation of the Signal Silence Switch shall cause all programmed Alarm Indicating Appliances and relays to return to the normal condition after an alarm condition. The selection of indicating circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. No delay in the activation.

3. System Reset Switch.
 - a. Activation of the System Reset Switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
 - b. If the alarm condition(s) still exist, or if they reoccur in the system after System Reset Switch activation, the system shall abort the reset and indicate as to this affect on the LCD display.
 4. System Test Switch.
 - a. Activation of the System Test Switch shall initiate an automatic test of all Intelligent/Addressable detectors in the system. The System Test shall activate the electronics in each intelligent sensor, simulating an alarm condition and causing the transmission of the alarm condition from that sensor to the Fire Alarm Control Panel. The Fire Alarm Control Panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the System Liquid Crystal Display, as well as on any CRTs or printers in the System.
 5. Lamp Test Switch.
 - a. Activation of the Lamp Test Switch shall sequentially turn on all LED indicators, System Liquid Crystal Display and Local Piezo-Electric signal, and then automatically return the Fire Alarm Control Panel to the previous condition.
- O. Dial-Up Connection
1. Provide RS232 port for dial up connection to down load event history. Provide Procom Plus 4.8, CD, Windows, by Symantec, #14-00-00397 or latest up-date and all programming required for start-up.
- P. System Expansion: Design the main FACP and transponders so that the system can be expanded in the future (to include the addition of thirty (30%) percent more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space. NAC panels shall have two spare circuits available for future use.
- Q. It shall be the responsibility of the equipment supplier /installer to ensure that all equipment supplied will fit in locations designated on plans and in the specifications. As-built drawings shall indicate all locations of control modules and conduit routing.
- R. Specific System Operations
1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the System keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
 2. Alarm Verification: Each of the Intelligent/Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The Alarm Verification Function shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification during the field programming of the system, or anytime after system turn-on. The Alarm Verification shall not require any additional hardware to be added to the Fire Alarm Control Panel. The FACP shall keep a count of

- the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. System Point Operations
 - a. Any Device in the system may be Enabled or Disabled through the system keypad or video terminal.
 - b. Any system output point may be turned on, or off, from the system keypad or the video terminal.
 4. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point will be annunciated for the parameters listed:
 - a. Device Status.
 - b. Device Type.
 - c. Custom Device Label.
 - d. Software Zone Label.
 - e. Device Zone Assignments.
 - f. Analog Detector Sensitivity.
 - g. All Program Parameters.
 5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status:
 6. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 400 system output/input/control activations. Each of these activations will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the History Buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
 7. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each Intelligent System Detector and shall analyze the detector responses over a period of time. If any Intelligent Detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular Intelligent Detector will be annunciated on the System Display, and printed on the System Printer. This feature shall in no way inhibit the receipt of Alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- T. All addressable devices, including detectors, bases, and control modules shall be labeled with the applicable station code, and/or point (SLC) address. All devices shall be labeled as to NAC panel and corresponding circuit.
- U. Audio Amplifiers
1. Each audio power amplifier shall have integral audio signal de-multiplexers, allowing the amplifier to select any one of eight digitized audio channels as directed by system programming.
 2. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall provide a selectable 25/70 Vrms output, suitable for connection to emergency speakers.

3. To enhance system survivability in the event of a total loss of audio data communications, all amplifiers shall default to the local "EVAC" tone generator channel. If the local panel has an alarm condition, then all amplifiers will sound the EVAC message on their speaker circuits. In the event of a loss of the fully digitized, multiplexed audio riser data, the audio amplifiers shall automatically default to an internally generated alarm tone which shall sound a 3-3-3 temporal pattern.
4. Amplifiers shall also include a 24 VDC notification appliance circuit rated at 24Vdc @ 3.5A for connection of visible (strobe) appliances. This circuit shall be fully programmable.
5. Provide as minimum, one twenty (20) watt audio amplifier per speaker circuit. Initial amplifier loading shall not exceed 80% in order to allow for future system expansion. Calculations shall assume each speaker is connected at one (1) watt.
6. Audio amplifiers shall be Notifier devices.

2.3 SYSTEM COMPONENTS:

- A. Manual Pull Station: Semi-flush mounted, supervised, normally open single action, addressable type manual pull station. Manual stations shall be single action and shall be constructed of impact resistant lexan with raised white lettering and a smooth high gloss finish. The station shall have a hinged front with key lock. Stations which utilize screwdrivers, Allen wrenches, or other commonly available tools shall not be accepted. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock in a protruding manner to facilitate quick visual identification of the activated station

1. Provide "Fire Alarm Pull Station Inside" signs at all exterior doors with a pull station inside.
2. In Building 10 (three-story classroom building) and Building 11 (Kitchen/Dining), provide a local protective cover for each pull station that includes a local audible alarm to help prevent or reduce false alarm by prank activation. Covers shall be clear lexan type with a hinged door.

B. Speakers and Strobes:

1. Speaker-Ceiling
 - a. Provide low profile ceiling mounted speaker at the locations shown on the drawings.
 - b. Speakers shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling.
 - c. The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position. Adjust all speaker outputs in the field as necessary.
 - d. The speaker shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.
 - e. The low profile ceiling mounted speaker shall be Notifier.
2. Speaker-Strobe-Wall
 - a. Provide low profile wall mounted speaker-strobes at the locations shown on the drawings.

- b. The low profile speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings, and protrude less than 1" from the finished wall. Exterior devices shall be installed in a weatherproof, watertight box.
 - c. The speaker output shall be switch selectable from the following available settings: 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
 - d. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position. Light shall be evenly distributed throughout the required volume using cavity and mask "FullLight" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.
 - e. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules
 - f. Speaker and strobe power, speaker silencing, and strobe synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.
 - g. Exterior devices shall be weatherproof, waterproof type.
 - h. The low profile wall mounted speaker-strobes shall be Notifier.
3. Speaker-Strobe-Ceiling
- a. Provide low profile ceiling mounted speaker-strobes at the locations shown on the drawings.
 - b. Speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling.
 - c. The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
 - d. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 95cd or 95cd, 115cd, 150cd, & 177cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position.
 - e. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules
 - f. Strobe power and synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.
 - g. The low profile ceiling mounted speaker-strobes shall be Notifier.

C. Strobe Lights:

- 1. Visual Flashing Lamps (Xenon Strobe): Visual indicating appliances shall be comprised of xenon flashtube and be entirely solid state and field adjustable. These devices shall be

- UL listed for use as a fire alarm indicating appliance and be capable of either ceiling or wall mounting. The lexan lens shall be pyramidal in shape to allow better visibility.
2. Shall operate on 24 VDC nominal.
 3. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
 - a. The maximum pulse duration shall be 2/10ths of one second.
 - b. Unless otherwise specified on the drawings or required for ADA compliance, the intensity shall be a minimum of 75 candela.
 - c. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
 - d. Strobes shall be synchronized wherever required by NFPA-72.
 4. Must be UL listed for system or current design with ADA required flash rate and intensity. Must be field adjustable.

D. Audible/Visual Combination Devices:

1. Audio/Visual Alarm Indicating Appliance: Audio/Visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate either horns, bells, chimes, or speakers. The unit shall be complete with a tamper resistant, pyramidal shaped lexan lens with "Fire" lettering visible from a 180 degree field of view. The front panel or bezel which is constructed of cast metal or LEXAN maybe inverted so that the lens is below the audible device. The lamp assembly shall incorporate a built-in reflector for more efficient light propagation and a special shock-mounting arrangement to resist lamp failure due o vibration. Unit shall be complete with all mounting hardware including backbox. Audio/Visual unit shall be UL Listed as a fire alarm indicating appliance.
2. Shall meet the applicable requirements of Section B listed above for audibility.
3. Shall meet the requirements of Section C listed above for visibility.
4. Notifier with the ADA required flash rate and intensity.

E. Intelligent Photoelectric Smoke Detectors

1. Smoke detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuit loops. Up to 250 intelligent detectors may connect to one SLC loop.
2. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
3. The detectors shall be ceiling-mount and shall include a twist-lock base. Detectors shall be capable of mounting in an audible base when provided.
4. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
5. The detectors shall provide address-setting means on the detector head using decimal switches. Because of the possibility of installation error, systems that use binary jumpers on dip-switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector.
6. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode

operation of the detector LEDs shall be controlled through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.

7. The detector sensitivity shall be set through the Fire Alarm Control Panel, and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
 8. Using software in the FACP, the detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
 9. Detectors shall be listed to U.L. Standard 268 and shall be documented compatible with the control equipment to which it is connected. Detectors shall be listed for this purpose by Underwriters Laboratories, Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. The operating voltage shall be 24 VDC (nominal). Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel.
 10. To minimize nuisance alarms, voltage and RF transient suppression techniques shall be employed as-well-as an insect screen. The detector head shall be easily disassembled to facilitate cleaning.
 11. Detector and associated base shall be labeled with the applicable matching station code.
 12. Notifier #FSP-851 or equal.
- F. Duct Mounted Smoke Detectors: Duct mounted smoke detectors shall be of the solid state photoelectric type and shall operate on the light scattering photodiode principle. The detectors shall be the same as the smoke detectors described in Section 2.04, E., above. Detectors shall be 4 wire operation, addressable type for use on an addressable type system. The detectors shall be mounted in a duct housing with an integral red LED which shall pulse continuously to indicate power on and glow continuously to indicate alarm or sensor trouble condition. The detectors shall be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive materials shall be used. Provide supervised automatic fan shutdown via the control panel.
1. Provide a remote alarm indicator with a test switch for duct mounted smoke detector.
 2. Provide a sampling tube sized for the required duct width and rated for the air velocity present in the duct. Existing sampling tubes may be reused, but shall be removed, cleaned and re-installed. Ductwork shall be repaired and insulation patched as required to seal the duct.
- G. Monitor Module (Individual Addressable Module)
1. Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any N.O. dry contact device), such as tamper switches and water flow switches, to the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.
 2. The Monitor Module shall mount in a 4-inch square, 2-1/8" deep electrical box. Label the box with an address point and box to be painted red.
 3. The IDC zone may be wired for Style D or Style B operation. The Monitor module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Fire Alarm Control Panel shall use to identify the type of device. Modules that use binary jumpers or dip-switches are subject to installation errors and are not acceptable. An LED shall be provided that shall flash under normal conditions,

indicating that the Monitor module is operational and in regular communication with the control panel.

4. All Monitor Modules shall be located in an accessible area without the need for a ladder.

H. Control Module

1. Addressable Control Modules shall be provided to supervise and control the operation of one conventional Indicating Appliance Circuit (IAC) of compatible, 24 VDC powered, polarized Audio/Visual Indicating Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.
2. The Control Module shall mount in a standard 4-inch square, 2-1/8" deep electrical box, or to a surface mounted backbox, or adjacent to the Fire Alarm Control Panel.
3. The IAC may be wired for Style Z or Style Y IAC (Up to 1 Amp of Inductive A/V Signal, or 2 Amps of Resistive A/V Signal) operation, or as a Dry Contact (Form C) Relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or IACs may be energized at the same time on the same pair of wires.
4. Audio/Visual Power shall be provided by a separate supervised Power Loop from the main Fire Alarm Control Panel or from a supervised, UL listed Remote Power Supply, as required. All NAC panels shall be mounted at 5" to the top of the panel. NAC panels are to be located in IDF rooms or electrical rooms. Mechanical rooms are acceptable only at listed heights.
5. The Control Module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Control Panel shall use to identify the type of device. Modules that use binary jumpers or dip-switches are subject to installation errors and are not acceptable. An LED shall be provided that shall flash under normal conditions, indicating that the Control Module is operational and is in regular communication with the Control Panel.
6. A magnetic test switch shall be provided to test the module without opening or shorting its IAC wiring.
7. Notifier #CMX-1 or equal.

I. Isolator Module

1. Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section of the SLC loop.
3. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
4. The Isolator Module shall mount in a standard 4-inch deep electrical box, in a surface mounted backbox, or in the Fire Alarm Control Panel. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
5. Notifier #ISO-X or equal.

J. Water flow Switches, where applicable:

1. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
2. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 — 45 seconds.
3. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

K. Sprinkler and Standpipe Valve Supervisory Switches, where applicable:

1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. Each Post Indicator Valve (PIV) or main gate valve (main site backflow preventor) shall be equipped with a supervisory switch. Provide supervisory monitoring circuit to the switch.
3. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The mechanism shall be contained in a weatherproof aluminum housing, that shall provide a 3/4 inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. Switch housing to be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

L. Serially Connected Annunciator Requirements

1. The system shall have the capability to connect all required annunciators. The Annunciators shall communicate with the fire alarm control panel via an EIA 485 (multi-drop) communications loop as a minimum, and shall be able to annunciate up to 64 points.
2. Annunciator shall be able to silence alarms.

M. LCD Alphanumeric Display Annunciator:

1. The Alphanumeric display annunciator shall be a supervised, local or remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. The annunciator shall connect to an EIA 485 interface.
4. Up to 32 LCD annunciators may be connected to the interface, each with Acknowledge, Silence and Reset controls for the FACP.

N. Door Holders

1. Provide magnetic door holders where indicated. Provide wall mounted with extended, adjustable stems to allow for adjustment in the door swing and distance from the wall. Door holders shall release upon initiation of the fire alarm system.

2.4 BATTERIES AND CHARGER:

A. Batteries:

1. Shall be 12 volt, Gell-Cell type.
2. Batteries shall have sufficient capacity to power the fire alarm system for not less than 48 hours plus 5 minutes of alarm, plus 30% spare additional capacity.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.
4. Provide battery calculations clearly indicating the required 30% spare capacity. Calculations shall be submitted for approval.
5. Provide separate battery cabinets where necessary.

2.5 LIGHTNING PROTECTION

- A. Provide surge suppression on all initiation device circuits (SLC loops) and all indicating appliance circuits. Surge suppression shall be UL listed and Fire marshal approved for use with the specific fire alarm system and control panel. Surge devices shall be installed in a separate cabinet with separate terminal boards from the control panel. Clamping voltage shall be 43 volts. EDCO #PC-642C for signal circuit and EDCO #P264 series for alarm circuits. EDCO only.
- B. Provide lightning and surge protection at all points entering and leaving the building (including walkways) and at the FACP location shown on the drawings.
- C. Provide 120 volt surge suppressor for the 120 volt power circuit to the FACP and all power expander panels. Leviton #51020WM or approved equal.

2.6 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT) AND CELLULAR COMMUNICATIONS

- A. Provide automatic digital cellular monitoring and signaling capability for connection of the fire alarm control panel to a remote monitoring company. Provide conduit and cabling from the fire alarm control panel to the DACT in order to transmit all trouble and alarm conditions. Coordinate connection and remote monitoring requirements with School Board telecommunications personnel.
- B. Provide an IP cellular fire alarm communicator compatible with dialer. Honeywell Model #HFW2A-COM (compatible with AT&T)
- C. Cellular antenna (outdoor) shall be provided as necessary, Honeywell Modle #CELL-ANT3DB
- D. Antenna adapter cable shall be Honeywell WA7626-CA
- E. RF Extension Cable Hex Crimp shall be Honeywell 7626-50HC
- F. The communicator shall annunciate all alarms, trouble signals, and supervisory signals to the remote monitoring location as a point-to-point address with the description of the device and the location by building and room number.

2.7 AUXILIARY CONTROLS, SUPERVISION AND OTHER INTERFACE

- A. Provide auxiliary control and supervisory circuits for smoke door closure, kitchen hood fire suppression systems, appliance shutdown (under kitchen hood), gas supply shutdown, kitchen supply fan shutdown and other Fire Marshal required control functions. Provide all required relays, circuits, power supplies and other requirements.
 - 1. Provide 24 volt shutdown circuit to shunt trip breakers for appliance shut-down or coordinate shunt trip voltage and use relays for shutdown. Coordinate requirements with the hood controls.
- B. Provide all required fan shut down circuits for all duct mounted smoke detectors on supply and return (where return detectors are applicable).
- C. Provide fire pump supervision for fire pump running, loss of phase, phase reversal, low fuel, and low battery. Provide supervisory circuits for all tamper and flow switches in and around the fire pump.
- D. Provide remote indicators for all devices hidden from view.
- E. Provide wall mounted, magnetic door holder/automatic door release devices. Door holder shall have a minimum 25 lbs. holding force. Provide supervised circuit to control door release. Wall mounted door holders shall be adjustable in length to coordinate with the angle of the door against the wall. Provide integral hinge type fire alarm door holder device where door does not seat against a wall. All magnets shall be rigidly mounted.
 - 1. Provide smoke detectors for door release duty in accordance with NFPA-72.
- F. Provide control circuit and relay as necessary to mute cafeteria/dining sound system and gymnasium sound system in the event of an alarm.
- G. Elevators Recall: Provide controls for elevator re-call via the system smoke detectors.
- H. Elevator Power Shut-down: Provide controls for elevator power shutdown via the system heat detectors in the elevator machine room and elevator hoistway. Provide 24 volt or 120 volt shutdown circuit to shunt trip circuit breaker(s). Coordinate shunt trip voltage with electrical contractor.
- I. Provide for supervision circuits of all sprinkler system water flow switches and tamper switches.
- J. All terminal cabinets shall be provided with plywood backboards painted on all sides with fire retardant paint, and all terminations shall be on terminal blocks. No wire nuts inside terminal cabinets.
- K. Provide auxiliary control circuits for fire/smoke damper controls.

2.8 FIRE ALARM VOICE COMMAND CONTROL PANELS WITH ANNUNCIATOR (FAVP)

- A. Provide fire alarm voice command control panels where indicated on the drawings and where specified herein. FAVP shall provide complete visual and audible annunciation of all alarm, trouble and supervisory conditions and shall also provide for alarm silence and acknowledge.
 - 1. Provide complete with voice command control for pre-recorded and live voice control (with integral mic).
 - 2. Shall be provided in the entrance/reception area of the Administration Suite and elsewhere as indicated on the drawings.

2.9 FIRE ALARM CABLING

- A. Backbone site cabling between buildings shall be fiber optic cable, minimum 6 strand, multi-mode, OM4, indoor/outdoor. Cable shall be approved for use by the fire alarm system manufacturer. The cable shall be rated for use outdoors, underground, and shall be installed in conduit point-to-point.
- B. Backbone cabling shall be looped for redundant communications.
- C. All fire alarm cabling, including the fiber backbone, shall be installed in conduit and shall be approved for use by the fire alarm system manufacturer.
- D. Provide all required media converters at or in each control panel in each building.
- E. The existing site fire alarm raceways may be reused but all existing fire alarm cabling shall be removed.
- F. Refer to Part 5 of these specifications for more wiring requirements.

PART 3 - SEQUENCE OF OPERATION

3.1 ENTIRE CAMPUS

- A. The system shall supervise all initiation devices and indicating appliances. Initiation devices shall, when placed in an alarm mode, sound all building general alarm, flash strobe lights, annunciate the address of the initiating device to the FACP, FAA, and notify the monitoring company through the DACT.
 - 1. Under normal operation the panel display shall indicate "SYSTEM NORMAL". And the current date and time.
 - 2. Upon initiation of an alarm, any initiating device, including any duct mounted smoke detector, and any sprinkler head via a flow switch shall:
 - a. Sound all fire alarm speakers with the appropriate message.
 - b. Flash all fire alarm strobes.
 - c. Automatically shutdown all air handler fans in all buildings. Global shutdown.
 - d. Release any magnetically held open doors.
 - e. Release all life safety egress access controlled doors.
 - f. Shutdown all gas supplied to the facility (if applicable)
 - g. Shutdown gas to kitchen via the kitchen hood controls (if applicable)
 - h. Visually indicate via the control panels and all remote annunciators the address, name, and location of the initiation device in alarm.

3. Activation of the elevator smoke and/or heat detectors shall place the fire alarm system into alarm and initiate elevator recall. Activation of the fire alarm system alone shall not cause elevator recall/capture.
 4. Activate all programmed indicating circuits until silenced.
 5. Actuate all programmed strobe units until the panel is reset.
 6. Annunciate the active initiating devices.
- B. All initiation devices shall, when placed in a trouble mode, indicate the address of the device experiencing trouble to the FACP, FAA and to the monitoring company via the DACT.

PART 4 - PROGRAMMING

4.1 PROGRAMMING AND SOFTWARE MODIFICATIONS

- A. The system shall be fully programmed, set up and made operational prior to substantial completion. The Contractor shall include re-programming of the system up to three more times after substantial completion (and for each phase of construction and each building if applicable) to make Owner requested revisions, Fire Marshal requested revisions or Engineer requested revisions to the program. The Contractor shall re-certify the system each time a program change is made and provide a new written certification.
- B. The FACP and CPU shall have the capability to be fully programmable by the Owner's via any factory authorized service technician. Provide a full copy of the system final program and settings on a CD in the project close-out documents. Also provide another copy of the CD inside the FACP. Any software required to modify and update the program shall be provided.
- C. The Manufacturer shall provide all the necessary documentation and training to allow the Owner's personnel to maintain the system and hire any factory authorized service technician to maintain the system.
- D. The services of a factory trained and authorized technician shall be available to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
- E. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
- F. All programming or editing of the program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
- G. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All programming shall be accomplished through the standard FACP keyboard or through the Video Display Terminal.
3. All field defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
5. The Fire Alarm Voice Evacuation language shall be programmed to state: Consult District for desired announcement.

PART 5 - EXECUTION

5.1 INSTALLATION OF FIRE ALARM AND DETECTION SYSTEMS

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
 1. Pay for all permits and fees.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed only in unfinished areas. Junction box covers shall be painted red. Conduit shall be spot painted red approximately every 4 feet. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage. All boxes, terminal and junction boxes shall be mounted in an accessible location without the use of a ladder.
 1. All control panels and terminal cabinets shall be installed on non-load bearing walls.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECAs "Standard of Installation" and NFPA-72E.
- E. Wiring Systems and Materials:
 1. Wiring shall be in accordance with requirements of the National Electrical Code (e.g., NEC Article 760) and NFPA Regulation 72 and as recommended by the manufacturer of the fire alarm system. The fire alarm system, including components and wiring shall be completely installed and wiring shall be properly tagged and color coded. The Electrical Contractor shall make final connections as shown and required by the equipment manufacturer's wiring instructions. Wire nuts are not acceptable.

2. All wiring shall be furnished by the fire alarm contractor. All fire alarm system wiring must be new. All underground cable shall be rated for wet locations. THHN and/or THWN are not acceptable.
 3. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 14 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 12 AWG (1.63 mm) for Indicating Appliance Circuits.
 4. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 5. Wiring used for the communication loop shall be twisted and shielded and installed in conduit. The system should permit use of IDC and IAC wiring in the same conduit with the communication loop.
 6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
 7. Color Code - The wire color for the addressible fire alarm cabling shall be consistent throughout the project. Submit proposed color coding prior to installation.
 8. All wiring to be installed in conduit with continuous ground.
 9. All junction box covers shall be painted red. All lengths of conduits shall be spot painted red approximately every 4 feet or more often if required by the Authority Having Jurisdiction.
 10. AHU shutdown relays and equipment control relays shall be mounted within three (3) feet of controlled device. AHU shutdown relays shall be wired on a separate, dedicated circuit.
 11. All boxes with internal devices, such as the CMX modules, shall be labeled as to the device inside, its station code and plain language address.
 12. All exposed devices shall have Roberts tamper proof screws.
 13. The use of wire nuts for wire splices and/or terminations is not acceptable. All terminations shall be made on terminals on fire alarm devices or inside terminal cabinets.
 14. End of line resistors shall be provided as required and installed per the manufacturer's instructions.
 15. Prior to construction, verify with the AHJ the preferred operation of the exhaust and supply fans (including cooking hood and heat removal fans) during alarm.
 16. Provide labor and materials to meet the AHJ requirements.
 17. All batteries shall be installed in a battery box near the control panel.
 18. Wall mount fire alarm terminal cabinets above the control panels.
- F. Provide conduit, wire and circuit breakers to connect fire alarm control panels to emergency circuit. Connection to the fire alarm system shall be on a dedicated branch circuit, maximum 20 amperes. The circuit breaker shall be accessible to authorized personnel only and shall be marked FIRE ALARM CIRCUIT CONTROL. Provide a padlockable handle lock. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG, copper minimum. The Control Panel Cabinet shall be grounded securely via a separate equipment grounding conductor to the panelboard equipment ground bar. The system ground shall be tested and corrected as necessary to allow proper system operation. Breaker lock is acceptable and include this provision on all NAC panel circuits (120 volt).
1. All fire alarm circuit breakers shall be locked in the on position and shall be painted red. This includes all breakers for control panels, voice panels, power supplies, and damper power.

- G. Provide a disable switch for system indicating appliances at the Fire Alarm Control Panel. Label switch 'ALARM SILENCE SWITCH'. (If the switch is left in the disable position during normal system operation, a trouble signal shall sound at the control panel.).
- H. Provide a disable switch at the control panel for AHU shutdown to override disable during system testing. Label switch 'AHU SHUTDOWN OVERRIDE'(If the switch is left in the disable position during normal system operation, a trouble signal shall sound at the control panel.).
- I. Provide a disable switch at the control panel for GAS SHUTDOWN to override disable during system testing. Label switch 'GAS SHUTDOWN OVERRIDE'(If the switch is left in the disable position during normal system operation, a trouble signal shall sound at the control panel.).
- J. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- K. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- L. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- M. All wiring shall be installed in conduit. Conduit shall be 1/2 inch minimum. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit. Conduit shall be installed in accordance with The National Electrical Code (NEC), local and state requirements. Underground conduit shall be at a minimum of 24" below grade. Provide a brightly colored plastic tape buried 6 inches below grade, above the fire alarm conduits, for identification purposes in case of future digging. All cabling or wiring underground shall be wet location rated. THHN and/or THWN are not acceptable.
- N. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
- O. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- P. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer. All conduits for FACP to enter separate cabinet adjacent to FACP.
- Q. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose. Mounting shall be at 5 feet or less to top of boxes. Ceiling mount is not acceptable.

1. All terminal cabinets shall be provided with plywood backboard inside the cabinet. Mount terminal strips to backboard. No wire-nuts permitted inside the terminal cabinets. Plywood shall be painted on all sides and edges with a fire retardant paint.
- R. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
- S. Pull stations to be labeled with its point address.
- T. Sensors to be labeled with its point address.
- U. Mounting and locating of Duct Detectors shall be to manufacturers specifications.
- V. Speaker DB level to adhere to NFPA code levels, but as a minimum shall meet NFPA requirements. Speaker wattages shall be adjusted in the field during initial testing, and then adjusted again if required by the Fire Inspector, Engineer or AHJ. Speaker circuits and conductors shall be sized for 1 watt per speaker per circuit.
- W. Provide approved clear covers on devices for areas prone to vandalism or other damage: Hallways, Common Bathrooms, Locker rooms, Gym, Dining.
- X. FACP shall be located not in Main Office, Lobby or other unsecured areas. Also surge suppression for FACP shall be mounted in approved separate cabinet located next to FACP.
- Y. Junction boxes to be readily accessible. If wall mounted do not mount less than 40" from finished floor. Ceiling mounting is not acceptable.
- Z. Free wire not acceptable. Entire system must be in conduit.
- AA. Installed system shall comply with all requirements of local authority.
- BB. The Fire Alarm system shall be UL listed as a Central Station Service.

5.2 QUALITY ASSURANCE

- A. NEC Compliance comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories.
- B. UL Compliance and Labeling - Provide fire alarm and detection system components which are UL listed and labeled. Installation is to be by a UL listed installer.
- C. Misc. compliance - The fire alarm system is to be installed in accordance with the equipment manufacturer's written instructions and comply with all applicable portions of the NECAs "Standard Installation" and all local codes and ordinances.

5.3 SYSTEM GUARANTEE, MAINTENANCE & TESTING

- A. All work performed and all material and equipment furnished under this contract shall be guaranteed against defects in materials and workmanship for a period of twelve (12) months

commencing the date of acceptance by the Fire Marshall and the School Board. Warranty service shall be provided by a qualified factory trained representative of the equipment manufacturer. Service response time shall be a maximum of four (4) hours before arrival to site. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submitted bid. The warranty shall include parts, labor, prompt field service, pick-up, and delivery.

- B. These warranty services for the fire alarm system shall be provided from a factory trained authorized representative of the manufacturer of the major equipment.

5.4 TESTING AND FIELD QUALITY CONTROL

- A. The Manufacturer's representative shall perform a quality inspection of the final installation and, in the presence of the Engineer, Electrical Contractor, fire marshal and Owner's Representatives, shall perform a complete functional test of the system. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Open initiating device circuits and verify that the trouble signal actuates.
3. Open signaling line circuits and verify that the trouble signal actuates.
4. Open and short indicating appliance circuits and verify that trouble signal actuates.
5. Ground initiating device circuits and verify response of trouble signals.
6. Ground signaling line circuits and verify response of trouble signals.
7. Ground indicating appliance circuits and verify response of trouble signals.
8. Check presence and audibility of tone at all alarm notification devices.
9. Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.
10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.
12. To assure that wire size, power supply, number of devices on a circuit, etc. are suitable to support 100% of devices being in alarm or operated simultaneously, this test shall include the following:
 - a. Place all sensors and monitor modules in alarm. Each shall display it's address and alarm condition. At least the first ten (10) devices on each circuit shall also have their alarm LEDs lighted.
 - b. Operate all control modules for the alarm or operated condition. Each module shall display it's address and condition.
 - c. Reset all alarmed and operated devices. The panel shall display the address or zone of any off-normal devices.
 - d. Test a representative number of sensors for alarm verification by momentarily testing for alarm. The sensor shall not initiate an alarm. Then, test by placing the sensor in alarm such that it remains in alarm for the selected verification time. The sensor shall initiate an alarm.

- e. In addition, the Contractor shall also perform all electrical and mechanical tests required by the equipment manufacturer's testing standards and the National Fire Protection Association - 72. All test and report costs shall be included in the contract price.
 - f. Inspect relays and signals for malfunctioning, and where necessary adjust units for proper operation to fulfill project requirements. Any fine adjustment shall be performed by specially trained personnel in direct employ of manufacturer of the fire alarm detection system equipment.
 - g. All duct mounted detectors shall be flow tested. Relocate duct smoke detectors not meeting the minimum flow requirements.
- B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.
- C. The Contractor shall supply personnel and required auxiliary equipment for testing without additional cost to the Owner.

5.5 DOCUMENTATION

- A. After completion of the tests and adjustments listed above, the Contractor shall submit the following information to the the School Board.
- 1. A copy of the test report described in this specification and a Certificate of Compliance prepared as per National Fire Protection Association Standard 72 and State Fire Marshal's Rule 4A-48 to be completed at final test.
 - 2. A checkout report shall be prepared by the installation technicians and submitted in triplicate, one (1) copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
 - a. A complete list of equipment installed and wired.
 - b. Indication that all equipment is properly installed and functions and conforms with these specifications.
 - c. Test result of individual initiating devices and indicating appliances.
 - d. Serial numbers, locations by address and model number for each installed detector.
 - e. Technician's name, certificate number and date.
 - 3. Affixed to FACP a standard service tag, as described in rule 4A-48 for fire alarm contractors by the Office of the State Fire Marshal.
 - 4. Before final acceptance of work; the Contractor shall deliver six (6) copies of a composite "Operating and Shop Maintenance Manual." Each manual shall contain, but not be limited to:
 - a. A statement of guarantee including date of termination and name and phone number of the person to be called in the event of equipment failure.
 - b. Individual factory issued manuals containing all technical information on each piece of equipment installed. In the event that such manuals are not obtainable from the factory, it shall be the responsibility of the Contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals.
 - c. Three (3) copy of all approved shop drawings, instruction sheets, operating instructions, and spare parts bulletins.

5. A system certification verifying the proper system operation shall be required prior to acceptance by the Owner.
- B. Provide typewritten, short form operation instructions and locate them at the fire alarm control panel in a location as instructed by the Owner.

5.6 INSTRUCTION AND TRAINING:

- A. Provide training for up to two separate four (4) hour training sessions on the programming, operation, maintenance, and repair of the system at the Contractor's expense. Training shall be certified by the manufacturer and be at different times at the convenience of the Owner. Include transportation, room and board where required for the necessary training. The training session, for personnel selected by the Owner, shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation. Videotaping of the training shall be an option of the School Board.
- B. Provide a written description of standard control panel functions and user instructions at each FACP. These instructions shall be written in standard laymen's English so that an unfamiliar operator can accomplish basic functions such as reset.
- C. Provide instruction as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- D. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation" to the Owner.
- E. Provide a copy of the software program on site in CD format, taped or otherwise permanently stored inside the FACP.

END OF SECTION 28 31 11