VOLUME 2

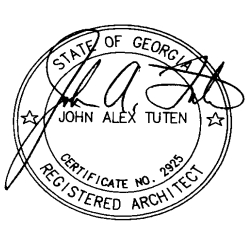
PROJECT MANUAL

SET NO. _____
PROJECT NO. 2035

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION

PHASE 4 – PE BUILDING,
ADMIN ADDITION AND NEW KITCHEN

FOR THE GLYNN COUNTY
BOARD OF EDUCATION



DATE: SEPTEMBER 26, 2022

JOHN A. TUTEN & ASSOCIATES, ARCHITECTS
4680 HIGHWAY 17 NORTH
BRUNSWICK, GA 31525
PHONE: (912) 265-8686

TABLE OF CONTENTS

VOLUME 2

SPECIFICATIONS

END OF TABLE OF CONTENTS – VOLUME 2

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 210110 – FIRE PROTECTION GENERAL PROVISIONS

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for plumbing work. In each case, the prevailing edition shall be the current adopted edition of the state where the project is located.

1. International Fire Code.
2. NFPA Documents.

1.03 SCOPE OF WORK:

A. Provide all labor, materials, equipment and supervision to construct complete and operable fire protection systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.04 RELATED DOCUMENTS AND OTHER INFORMATION:

A. The general provisions of the Contract, including General and Special Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

B. It is recognized that separate sub-contracts may be instituted by THIS CONTRACT'S GENERAL CONTRACTOR with others. It is the responsibility of THIS CONTRACT'S GENERAL CONTRACTOR to completely inform, coordinate and advise those sub-contractors as to all of the requirements, conditions and information associated with providing and installing their portion of the total job.

1.05 EXISTING SERVICES AND FACILITIES:

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

C. Removed Materials: Existing materials made unnecessary by the new installation shall be removed, shall remain the property of the Owner and shall be stored at a location and in a manner as directed, or, if classified by the Owner's authorized representative as unsuitable for further use, shall become the property of the Contractor and shall be removed from the site.

1.06 PRODUCT WARRANTIES:

A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.07 PRODUCT SUBSTITUTIONS:

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect at least 10 days prior to opening of bids.

PART 2. - PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. Standard Products: Provide not less (quality) than manufacturer's standard products, as specified by their published product data. In addition to the indication that a particular product/model number is acceptable, comply with the specified requirements. Do not assume that the available off-the-shelf condition of a product complies with the requirements; as an example, a specific finish or color may be required.

B. Uniformity: Where multiple units of a general product are required for the work, provide identical products by the same manufacturer, without variations except for sizes and similar variations as indicated.

C. Product Compatibility, Options: Where more than one product selection is specified, either generically or proprietarily, selection is Purchaser's or Installer's option. Provide adaptations as needed for interfacing of selected products in the work.

D. Equipment Nameplates: Provide a permanent operational data nameplate on each item of power operated equipment, indicating the manufacturer, product name, model number, serial number, speed, capacity, power characteristics, labels of tested compliance, and similar essential operating data.

E. Locate nameplates in easy-to-read locations. When product is visually exposed in an occupied area of the building, locate nameplate in a concealed position (where possible) which is accessible for reading by service personnel.

PART 3. - EXECUTION

3.01 PRODUCT INSTALLATION, GENERAL:

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.

END OF SECTION 210010

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 210120 - FIRE PROTECTION STANDARDS

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE

A. Industry Standards: It is a general requirement that plumbing work comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to the extent more detailed and stringent requirements are indicated or required by governing regulations. Listing of Associations, Standards, and Abbreviations:

1. AWS	American Welding Society, Inc. 2501 NW 7th St., Miami, FL 33125 (305) 642-7090
2. CISPI	Cast Iron Soil Pipe Institute 2020 K. St., NW, Washington, DC (202) 233-4536
3. NEC	National Electrical Code by NFPA
4. NEMA	National Electrical Manufacturers Association 1300 N 17th Street, Suite 1847 Rosslyn, VA 22209 (703) 841-3200
5. NFPA	National Fire Protection Association 407 Atlantic Ave., Boston, MA 02210 (617) 482-8755
6. UL	Underwriters' Laboratories, Inc. 207 East Ohio St. Chicago, IL 60611 (312) 642-6969

PART 2. - PRODUCTS

Not used.

PART 3. - EXECUTION

Not used.

END OF SECTION 210120

SECTION 210210 - FIRE PROTECTION COORDINATION

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE:

A. Coordinate the actual location of all fire protection work visible in finished spaces with the Architect/Engineer.

PART 2. - PRODUCTS

2.01 PRODUCT COORDINATION:

A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power driven item of equipment. The electrical design was based on the typical power requirements of the equipment manufacturers scheduled or specified. Any modifications to the electrical system which are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Architect/Engineer prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. The fire protection contractor shall furnish a detailed list of equipment electrical characteristics to the electrical contractor for the purpose of preparing the coordination affidavit required by Division 26.

B. Coordination of Options and Substitutions: Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface of equipment has been checked and satisfactorily established.

C. Firestopping: Refer to architectural drawings for the locations of all fire rated ceilings, floors and walls. The contractor shall furnish detailed shop drawings of all firestopping details to be used for both piping and ductwork. All firestopping details shall be U.L. listed and subject to approval by the Authority having jurisdiction.

PART 3. - EXECUTION

3.01 INSPECTION AND PREPARATION:

A. Substrate Examination: The Installer of each element of the work must examine the condition of the substrate to receive the work, and the conditions under which the work will be performed and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until coordination drawings have been processed and released for construction. Where work must be installed prior to that time in order to avoid a project delay, review

proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

3.02 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks and other members intended to withstand stress, except with the Architect's or Engineer's written authorization. Authorization will be granted only where there is no other reasonable method for completing the work, and where the proposed cutting clearly does not materially weaken the structure.

B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work. Review the proposed cutting with the Installer of the work to be cut and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Where patching is required to restore other work, because of either cutting or other damage inflicted during the installation of fire protection work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Architect. Engage the original Installer to complete patching of the following categories of work:

1. Exposed concrete finishes.
2. Exposed masonry.
3. Waterproofing and vapor barriers.
4. Roofing, flashing and accessories.
5. Interior exposed finishes and casework, where judged by the Architect to be difficult to achieve an acceptable match by other means.

3.03 COORDINATION OF FIRE PROTECTION INSTALLATION:

A. General: Sequence, coordinate and integrate the various elements of fire protection work so that building systems will perform as indicated and be in harmony with other work of the building. The Architect/Engineer will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:

1. Install piping and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation where applicable. Conceal where possible.
2. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
3. Give the right-of way to piping systems required to slope for drainage (over other service lines). Piping shall be located to avoid interference with ductwork and light fixtures.
4. Store materials off the ground and protected from standing water and weather.

B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.

C. Electrical Work: Coordinate the fire protection work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install fire protection equipment ready for electrical connection. Refer to electrical sections of the specifications for electrical connection of fire protection equipment.

D. Utility Connections: Coordinate the connection of fire protection systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Provide a single connection for each service except where multiple connections are indicated.

END OF SECTION 210210

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 210220 - FIRE PROTECTION SUBMITTALS

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUBMITTAL FORMS AND PROCEDURES:

A. The purpose of submittals is to demonstrate to the Architect/Engineer that the Contractor understands the design concept. The Architect/Engineer's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has, in writing, called the Architect/Engineer's attention to such deviations at the time of submission, and has received from the Architect/Engineer, in writing, permission for such deviations. All submittals must be completely checked by the Contractor prior to submission for review.

B. Quantities: Except as otherwise indicated in other sections, submit 5 copies. Quantity indicated does not include copies required for regulatory agencies.

C. Submittals shall be made for all items contained in the following specification sections:

1. Fire Protection Coordination
2. Fire Protection Identification
3. Fire Protection Pipe, Tube, and Fittings
4. Fire Protection Hangers and Supports
5. Fire Protection Seismic Control
6. Fire Protection Sprinkler System
7. Hydraulic Calculations

D. Response to Submittals: A Submittal Review Report shall be issued by the Architect/Engineer with the following classifications for each item:

1. **"No Exceptions Taken"**: No corrections, no marks. Contractor shall submit copies for distribution.
2. **"Make Corrections Noted"**: A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.
3. **"Revise and Resubmit"**: Minor corrections. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
4. **"Rejected"**: Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

E. Coordinate fire protection submittals through the Contractor for the general work, and mark each submittal with his name and the date of the transmittal to the Architect/Engineer. Prior Approvals or Submittals must be received by mail or be hand delivered. Submittal data received by facsimile machine is not acceptable and will not be reviewed.

1.03 FORMAT:

A. Submittals shall be made by specification section. Submittal data shall be placed in one or more hard-back 3-ring binders arranged and labeled according to specification section.

1. Each binder shall contain a title page and table of contents. Provide separator tabs, and **label by specification section**. Make note in the table of contents, any drawings that accompany the submittal.
2. Title page shall contain Project Name, Contractor's Name, Division 16 Superintendent's name, Suppliers and point of contact for each, and date.

PART 2. - PRODUCTS

2.01 SUBMITTAL REQUIREMENTS:

A. General: Each specification section shall list the required submittal items. All submittal items shall conform to the requirements listed below. For each major section of submittal data, include a summary page which lists items and model numbers for each piece of equipment.

B. Shop Drawings: Prepare shop drawings to accurate scale except where diagrammatic representations are specifically indicated. Show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment. Show piping connections and other service connections and show interface with other work including structural support. Indicate by note, the portions of fire protection work shown on the shop drawings which deviated from the indication of work in the contract documents and explain the reasons for the deviations. Show how such deviations coordinate with interfacing deviations on shop drawings for other portions of the work, currently or previously submitted.

C. Manufacturer's Data: Where pre-printed data is submitted for more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided. Delete or mark-out significant portions of preprinted data which are not applicable. Where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe a non-standard product must be processed as a shop drawing submittal. For each product include the manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), sizes, weights, speeds, operating capacities, piping and service line connection sizes and locations, statements of compliance with required standards and governing regulation (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with the requirements.

D. Certifications: Where specifically indicated, submit with notarized execution.

E. Test Reports: Submit test reports which have been signed and dated by the firm performing the test and prepared in the manner specified in the standard or regulation governing the test procedures as indicated.

F. Manufacturer's Product Warranties: Where pre-printed and published warranty includes substantial deviation from required warranty (as judged by the Architect or Engineer), product is automatically disqualified from use on the project, except where manufacturer prepares and issues a specific product warranty on the product, stating that it is in lieu of the published warranty, and is executed by an authorized officer, and complies with the requirements. Warranties shall comply with the requirements of individual specification section where those requirements exceed the manufacturer's standard warranty.

PART 3. - EXECUTION

3.01 CLOSEOUT REQUIREMENTS:

A. Operating Instructions: Submit manufacturer's operating instructions for each item of fire protection equipment and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for charging, start-up, control or sequencing of operation, phase or seasonal variations, shut-down, safety and similar operational instructions. Prepare in typewritten form in completely explained and easily understood English language.

B. Maintenance Manuals: Organize each copy of the required system maintenance manuals to include an index followed by thumb-tab marked sections for each of the following:

1. System operating instructions.
2. Emergency instructions including addresses and telephone numbers of service sources.
3. Regular system maintenance procedures including lubrication.
4. Spare parts listing and stocking recommendations.
5. Inspection, adjusting, rebalancing, cleaning, parts replacement, and similar maintenance instructions and recommendations, including the proper use of tools and accessories.
6. Valve schedule and control diagram for each system.
7. Manufacturer's data for each operating item in each system.
8. Manufacturer's product warranties and guarantees relating to the system and equipment items in the system.
9. Corrected or approved issues of submittal items relating to the system.
10. Bind each maintenance manual in one or more vinyl-covered, 2", 3-ring binder, plus pocket-folder type binders for folded drawings, and mark the back spine of each binder with system identification and volume number.

C. Maintenance Materials: Deliver to Owner’s representative at the location as directed, in containers or packages suitable for storage and fully identified.

D. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each guarantor and bears the corporate seal.

END OF SECTION 210220

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 210230 - FIRE PROTECTION IDENTIFICATION

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of identification systems required for this product.

B. Submittals: Submit manufacturer's data on materials and submit a sample of each type required.

PART 2. - PRODUCTS

2.01 FIRE PROTECTION IDENTIFICATION MATERIALS:

A. Plastic Pipe Markers:

1. General: Product manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
2. Small Pipe: For external diameters less than 6 inches, provide full band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   b. Adhesive lap joint in pipe marker overlap.
   c. Laminated or bonded application of pipe marker to pipe.
   d. Taped to pipe with color-coded plastic adhesive tape, not less than 3/4 inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inch.
3. Large Pipes: For external diameters of 6 inches and larger, provide either full-band or strip-type pipe markers, but not narrower than 3 x letter height (and of required length), fastened by one of the following methods:
   a. Laminated or bonded application of pipe marker to pipe.
   b. Taped to pipe with color-coded plastic adhesive tape, not less than 1-1/2 inches wide: full circle at both ends of pipe marker, tape lapped 3 inches.
4. Lettering: Comply with piping system names as specified, scheduled or shown, and abbreviate only as necessary for each application length.
5. Arrows: Print each pipe marker with arrow indicating direction of flow, either integrally with piping system service lettering or as separate unit of plastic (to accommodate both directions).
6. Install pipe markers on piping of the following piping systems:
   a. Automatic Wet Pipe Sprin kler System Water

B. Plastic Tape: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

1. Width: Provide 1-1/2 inches wide tape markers on pipes with outside diameters of less than 6 inches, 2-1/2 inches wide tape on larger pipes.
2. Color: Comply with ANSI A13.1.

C. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminated, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core, letter color, except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/16 inch, except as otherwise indicated.
3. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

D. Valve Tags:

1. Valve tags shall be 18-gauge (minimum) brass with 1-1/4" (minimum) height and width. Identification letters and numbers shall be stamped in tag and shall be filled with black paint.
2. Valve tags shall be attached to valve using cable ties. Cable ties shall be self-locking nylon ties.
3. Valve tags shall be installed at all shut-off, balancing, metering, and drain valves. Valve tag shape and designations shall with NFPA and UL.

E. Valve Charts:

1. Valve charts shall be provided for fire protection systems. Charts shall be located at the riser.
2. Valve charts shall be typed listing all valve tags. List shall include identification number, valve location in system (e.g., Corridor 123, etc.) and its function (e.g., shut-off, balancing, drain, etc.). Charts shall be mounted in a wooden frame with glass cover.

2.02 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in the identification work, with the corresponding designations shown, specified or scheduled. Provide numbers, lettering recommended by manufacturers or as required for proper identifications and operation/maintenance of the systems and equipment.

B. Multiple Systems: Where multiple systems of the same generic name are shown and specified, provide identification which indicates the individual system number as well as the service.

PART 3. - EXECUTION

3.01 APPLICATION AND INSTALLATION:

A. Coordination: Where identification is to be applied to surfaces which require painting and other covering or finish, including valve tags in finished spaces, install identification after completion of covering or painting.

B. Piping System Identification:

1. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.

C. Locate pipe markers as follows wherever piping is exposed to view in mechanical rooms, accessible maintenance spaces (including accessible areas above ceilings) and exterior non-concealed locations:

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures. Mark each pipe at branch, where there could be a question of flow pattern.
3. Near locations where pipes pass through walls or ceilings, or enter non-accessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced intermediately at maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment.

D. Do not mark piping exposed in finished occupied spaces.

E. Fire protection Equipment Identification: Install an engraved plastic laminate sign on or near each major item of fire protection equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for all major items of fire protection equipment.

F. Valve tags shall be attached to the valve handwheel with cable ties.

END OF SECTION 210230

SECTION 210240 - FIRE PROTECTION WORK CLOSEOUT

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 DOCUMENTATION PROCEDURES

A. Signed Commitments: Do not proceed with transfer of fire protection systems to the Owner for operation until warranties, performance certifications and similar commitments to be signed by Contractor and other entities have been executed and transmitted to Architect (for Owner's records).

1.03 RECORD DRAWINGS

A. Explanation: Except where otherwise indicated, fire protection drawings (contract drawings) prepared by Architect/Engineer, contract/drawings, are diagrammatic in nature and may not show locations accurately for various components of fire protection systems. Shop drawings, including coordination drawings, prepared by Contractor shall show certain portions of work more accurately to scale and location, and in greater detail.

B. General Recording Procedure: Maintain a white-print set, blue-line or black-line, of fire protection contract drawings and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing the installed conditions accurately; however, where shop drawings are marked, record a reference note on appropriate contract drawing. Mark with erasable pencil and use multiple colors to aid in the distinction between work of separate systems. In general, record every substantive installation of fire protection work which previously is either not shown or shown inaccurately, but in any case record the following:

1. Underground and aboveground piping, both exterior and interior, drawn to scale and fully dimensioned.
2. Fire protection "Project Record" shall be maintained as part of the "Project Record" specified in Division 1.

PART 2. - PRODUCTS

Not Used

PART 3. - EXECUTION

3.01 CLOSEOUT PROCEDURES:

A. General Coordination: Sequence closeout procedures properly, so that work will not be endangered or damaged, and so that every required performance will be fully tested and demonstrated.

B. System Performance Test Run: At the time of fire protection work closeout, check each item in each system to determine that it is set for proper operation. With Owner's representative and Architect/Engineer present, operate each system in a test run of appropriate duration to

demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of system to refine and improve performances wherever possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices as may be requested for Architect's/Engineer's observation of actual system performances. Demonstrate that controls and items requiring service or maintenance are accessible. Test run shall be scheduled to coincide with Engineer's final inspection of the fire protection work.

C. Cleaning and Lubrication: After final performance test run of each fire protection system, clean system. Lubricate both power and hand operated equipment and remove excess lubrication. Touch-up minor damage to factory painted finishes and other painting specified as fire protection work; refinish work where damage is extensive.

D. General Operating Instructions: In addition to specified training of Owner's operating personnel specified in individual fire protection sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified, provide general operating instructions for the fire protection systems. Conduct a walk-through explanation and demonstration for orientation and education of Owner's personnel to be involved in continued operation of building.

1. Describe each basic system and how its control system functions.
2. Explain and point out identification system, displayed diagrams, signals, alarms and similar provisions of the work.
3. Describe basic sequencing requirements and interlock provisions for system start-up, phasing and shut-down.
4. Emphasize emergency procedures and safety provisions for protection of equipment and safety of occupants during equipment malfunction, disasters, power failures and similar unusual circumstances.
5. Outline basic maintenance procedures.

E. Demonstrate what adjustments have been made and can continue to be made to reduce noise and vibration, improve system output, decrease energy consumption and similar performance improvements.

F. Point out operational security provisions, safety, unavoidable hazards and similar operator limitations. Display and conduct a "thumb-through" explanation of maintenance manuals, record drawings, meter readings and similar service items.

G. Construction Equipment: After completion of performance testing and Owner's operating instructions and demonstrations, remove installers tools, test facilities, construction equipment and similar devices and materials used in execution of the work but not incorporated in the work.

3.02 CONTINUED SYSTEM OPERATIONS

A. Final Acceptance: At time of substantial completion of fire protection work, Owner's operating personnel will take over operation of fire protection systems. However, until time of final acceptance, respond promptly with consultation and services on whatever operation or maintenance problems may remain or arise.

END OF SECTION 210240

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 210310 - FIRE PROTECTION EXCAVATION

PART 1. - GENERAL

All BACKFILL PROCEDURES AND MATERIALS SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT RECOMMENDATIONS.

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE:

A. Coordination: Where excavation and backfill for fire protection work passes through or occurs in the same areas as work specified in the Division 2 sections, comply with both the requirements of the Division 2 sections and the requirements of this section, whichever is the more stringent (as determined by the Architect/Engineer in cases of conflicting requirements).

1.03 JOB CONDITIONS:

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

PART 2. - PRODUCTS

2.01 BACKFILL MATERIALS

A. Subbase Material: A graded mixture of gravel, sand, crushed stone or crushed slag.

PART 3. - EXECUTION

3.01 EXCAVATING:

A. Inspection: The excavator must examine the areas to be excavated, and the conditions under which the work is to be performed, and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with excavating until unsatisfactory conditions have been corrected in a manner acceptable to the excavator.

B. General:

1. Do not excavate until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimum.
2. Provide signs, illuminations and barricades as necessary to prevent accidents at excavations.
3. Excavate with vertical sided excavations to the greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at a sufficient distance below finished grade to not interfere with other work.

4. Excavate for piping with 6" to 9" clearance both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Provide a minimum of 12" clearance around underground tanks.
5. For work to be supported directly on undisturbed soil, do not excavate beyond required depths, and hand excavate the bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at the bottom of the excavations:
   a. Piping of 5" and less pipe/tube size.
   b. Cast-in-place concrete.
6. Where directed, excavate additional depth to reach satisfactory soil-bearing conditions. Backfill with subbase material compacted as directed, to indicate excavation depth.
7. Except as otherwise indicated, excavate for exterior water-bearing piping so that the top of piping will not be less than 2'- 0" vertical distance below finished grade.
8. Store excavated material (temporarily) near the excavation, in a manner which will not interfere with or damage the excavation or other work.
   a. Retain excavated material which complies with the requirements for backfill material.
   b. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirement for backfill material.

3.02 DEWATERING:

A. Maintain dry excavations by removing water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations from being damaged by water, sediment or erosion from or through excavations.

3.03 BASE PREPARATION:

A. Install subbase material to receive fire protection work, and compact by tamping to form a firm base for the work. For piping, shape the subbase to fit the shape of the bottom 90 degrees of the cylinder, for uniform continuous support.

B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanges connections, valves and similar enlargements in the piping systems.

3.04 BACKFILLING:

A. Do not backfill until installed work has been tested and accepted, wherever testing is indicated.

B. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

C. Backfill simultaneously on opposite sides of work and compact simultaneously; do not dislocate the work from installed positions.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.

1. Lawn/Landscaped Areas: 90%
2. Roadways: 95%
3. Paved Area, Other than Roadways: 95%

E. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

F. Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by the Architect/Engineer.

3.05 PERFORMANCE AND MAINTENANCE:

A. Where subsidence is measurable or observable at fire protection work excavations during the guarantee period, remove the surface (pavement, lawn or other finish), add backfill material, compact and replace the surface treatment. Restore the appearance, quality and condition of the surface or finish to match adjacent work and eliminate evidence of the restoration to the greatest extent possible.

END OF SECTION 210310

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 212010 – FIRE PROTECTION SPRINKLER SYSTEM

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SCOPE:

A. Fire Protection Supply Pipe: Route the building fire main to the city water main and connect to the supply line at the appropriate time and location. Contractor shall field verify exact location of water main prior to start of construction.

B. Work Includes but is not limited to:

1. Installing a complete "wet pipe" Automatic Sprinkler system throughout the building.

C. Related Work Specified Elsewhere:

1. Wiring of flow alarm switches and tamper switches and connection of switches to building alarm system are specified in Section 271010.

D. Sprinkler Design Requirements: (for light hazard)

1. The sprinkler system shall be a wet pipe type. The design area shall be the most remote 1500 square feet. The design density for light hazard shall be 10 gpm/ft^2. Hose requirement for light hazard shall be 100 gpm. The design density for ordinary hazard – group 1 shall be 15 gpm/ft^2. Hose requirement for ordinary hazard – group 1 shall be 250 gpm. The design density for ordinary hazard – group 2 shall be 20 gpm/ft^2. Hose requirement for ordinary hazard – group 2 shall be 250 gpm.
2. The contractor shall submit 4 complete sets of sprinkler shop drawings and hydraulic calculations to the architect for review, prior to ordering material and/or cutting pipe. Contractor shall not cut any piping until shop drawings have been reviewed and accepted. The contractor shall show in dashed lines the location of all ductwork, lights and diffusers.
3. The contractor shall be responsible for coordinating sprinkler piping and heads locations with other trades. Contractor shall relocate sprinkler piping and heads as necessary in order to avoid conflict with ductwork, lights and structure.
4. Provide auxiliary drains at low points in system and for trapped sections as required by NFPA-13. Locate auxiliary drains in mechanical closets or other locations out of sight.

1.03 QUALITY CRITERIA:

A. Permits, Licenses, Inspection Fees:

1. Obtain and pay for permits, licenses and inspection fees as may be required for performance and approval of the work performed under this section of the specifications.
2. Comply with all requirements of NFPA 13, NFPA-24 and the State Fire Marshall and local codes.

B. Materials: Materials specified by manufacturer's name shall be used unless prior approval of a substitute is given by addenda.

1.04 SUBMITTALS:

A. Before materials and equipment are purchased, submit for Architect's approval, a complete schedule of materials and equipment to be incorporated in the work. Submittals shall include the following:

1. Complete Shop Drawings with hydraulic calculations
2. All Valves
3. Fire Department Connections
4. Sprinkler Heads
5. Tamper Switches
6. Pipe Hangers and Supports
7. Pipe and Fittings
8. Cabinets
9. Access Panels
10. Alarm Valve

B. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable style number.

C. Sprinkler heads shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.05 TESTING PIPE SYSTEMS:

A. Tests shall be conducted in the presence of the Architect or his designated representative. Equipment, materials, and instruments for testing shall be furnished by the Contractor without additional cost to the Owner.

B. Automatic Sprinkler Piping: The automatic sprinkler systems shall be hydrostatically tested in their entirety or in zones defined by shut-off valves. The piping shall be tested at a pressure of 200 psig , measured at the low point in the system or zone, and shall be proved tight at this pressure for a period of not less than two hours. Leaks detected shall be repaired by tightening, rewelding joints, or replacing damaged pipe or fittings. Caulking of joints will not be permitted.

1.06 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Operating and Maintenance Instructions, printed and bound in hard cover three ring loose leaf notebooks, shall be provided for each item of equipment listed below; 5 separate copies shall be provided. Each notebook shall be provided within an identifying label under a clear plastic cover shield on the front cover which shall identify the Project, Engineer, Contractor and Date.

1. National Fire Protection Association Pamphlet No. 25. Photo copies are not acceptable.
2. Copies of All Approved Submittal Data (listed above under submittals).
3. As-Built copies of Design Drawings and Hydraulic Calculations.

1.07 SEISMIC REQUIREMENTS:

A. Provide seismic protection for the sprinkler system. Design and install seismic protection in accordance with the requirements of NFPA 13 section titled "Protection of Piping Against Damage Where Subject to Earthquakes."

1.08 GUARANTEE:

A. All equipment shall be guaranteed as specified under the General and Special Conditions. Guarantee on all equipment shall start and coincide with the Contractor's guarantee obligations.

PART 2. - PRODUCTS AND INSTALLATION

2.01 PIPE AND FITTINGS:

A. Pipe and fittings listed herein shall be for the services indicated.

2.02 SPRINKLER AND STANDPIPE:

A. Piping Options:

1. Schedule 40 black steel pipe: ASTM A-795, A-53, or A-135 with class 150 or 300 pound malleable iron threaded fittings, welded steel fittings, or with mechanical grooved joint couplings. Mechanical couplings for main sprinkler and standpipe risers shall be rigid type coupling.
2. Schedule 10 black steel pipe: ASTM A-135 pipe, UL listed for sprinkler systems. Fittings for thin wall pipe shall be same type specified for Schedule 40 pipe.

2.03 JOINTS:

A. Mechanical grooved joint couplings shall be listed for use in fire protection systems.

1. Grooved End Fittings: Fittings shall be ductile iron (ASTM A536); forged steel (ASTM A234); or fabricated from carbon steel pipe (ASTM A53); with pre-grooved ends for use with mechanical couplings of the same manufacturer.
2. Mechanical Couplings: Coupling housings shall be ductile iron (ASTM A536). Bolts and nuts shall be carbon steel track-type (ASTM A183), minimum tensile 110,000 psi. Gaskets shall be Grade “E” EPDM, for water services from -30 to +230□F. At joints allowing controlled movement, expansion, contraction of deflection, flexible couplings with shall be used. At all joints not requiring flexibility, a rigid coupling shall be used.
   a. Rigid Type: Coupling housings cast with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with NFPA 13.
   b. Flexible Type: Use in locations where vibration attenuation and stress relief are required.
3. Flange Adapter: Flat face, for direct connection to ANSI Class 125 or 150 flanged components.

B. Welded flanged joints shall be faced true, provided with 1/16-inch ring type gasket, and made square and tight. Flanges shall have raised or flat faces to mate with adjacent flanges or valves. Welding shall comply with ANSI B31.1.

C. Welded joints shall be butt welded in accordance with ANSI B31.1.

D. Qualification of Welders

1. All welders employed for the work shall be qualified under the requirements of ANSI B31.1.0, Section 127.5.

2. Evidence of the welder's qualifications shall be submitted to the Architect before any welds are made.
3. Coupling for sprinkler piping shall be Victaulic Model 75.

E. Underground Pipe

1. Standard weight ductile iron pipe with mechanical "bolted type" joints.
2. Provide tie rods and thrust blocks at each change of direction of the underground fire service piping. Install tie rods and thrust blocks in accordance with NFPA-24 requirements.

2.04 FIRE DEPARTMENT VALVES:

A. Valves:

1. Valves of the same type shall have the name or trademark of the manufacturers and the working pressure stamped or cast on the valve body.
2. All valves installed in horizontal lines shall be installed with the stems horizontal or above. Valve handwheels shall be oriented, when installed, to provide maximum accessibility for operation.
3. All valves requiring packing shall be designed and constructed such that they can be repacked under pressure.
4. Valve handwheels shall be malleable iron.
5. Fire Department Valves: Fire department angle valves shall be 1½" size pressure reducing type complete with cap and chain. Valves shall have polished brass finish and shall be by Elkhart, Potter-Roemer or equivalent by Nibco or Sierra.

2.05 VALVES FOR COMPRESSED AIR SYSTEMS:

A. Globe Valves: Globe valves shall have bronze body, rising stem, composition disc, threaded ends for 200-pound W.O.G. and shall be Crane, No. 7; Stockham, B-13T or Nibco/Scott, T-211-Y. Ball valves may be substituted for globe valves with compressed air piping systems at the contractor's option.

B. Check Valves: Check valves shall be vertical lift type with bronze body, composition disc, threaded ends of 300-pound W.O.G. and shall be Crane, No. 27; Hammond, IB948 or Stockham, B-322. Grooved end spring actuated check valves may be used in grooved end piping systems.

2.06 VALVES, EQUIPMENT AND ACCESSORIES FOR FIRE PROTECTION SYSTEM:

A. Gate Valves 2½ Inch and Larger: Valves shall be O.S. and Y type with iron body, bronze trim, solid wedge, and flanged ends for 175-pound W.W.P. Valves shall be U.L. listed with identification mark for such stamped or cast on valve body. Valve shall be Crane, No. 467; Stockham, G-634, Nibco/Scott, F-607-0 or Kennedy, Figure 68.

B. Gate Valves 2 Inches and Smaller: Valves shall be O.S. and Y type with bronze body, solid wedge, and threaded ends for 175-pound W.W.P. Valves shall be U.L. listed with identification mark for such stamped or cast on valve body. Valves shall be Crane, No. 459; Stockham, B-133; Nibco/Scott, T-104-0 or Kennedy, Figure 66.

C. Check Valves 2 Inches in Size and Smaller: Check valves shall be horizontal swing type with bronze body, composition disc, threaded ends for 200 pound W.O.G. and shall be Crane, No. 34-1/2; Stockham, B-305-B; Nibco/Scott, T-413-W or Kennedy, Figure 440.

D. Swing Check Valves 2½ Inch and Larger: Check valves shall be horizontal swing type with iron body, bronze trim, and flanged ends for 175 pound W.W.P. Valves shall be UL listed with identification mark for such stamped or cast on the valve body. Valves shall be Crane, No. 375; Stockham, G-939; Nibco/Scott, F-0908-B or Kennedy, Figure 126.

E. Wafer Check Valves 4 inch and Larger: Valves shall be iron body with bronze trim, EPDM O-ring seals and stainless steel Hinge pins. Valve shall be UL listed and FM approved. Wafer check valves shall be Grinnell Model F512, or equivalent by Victaulic or Gruvlock.

F. Spring-Assisted Check Valves 2½ inch and Larger: Valve shall be UL listed and FM approved. Valves shall have a ductile iron body with aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft and grooved ends. Spring-assisted check valves shall be Victaulic or Gruvlock.

G. Butterfly Valves 2½ inch and Larger: Valve shall be UL listed and FM approved. Valves shall have a ductile iron body, elastomer encapsulated ductile iron disc with integrally cast stem and grooved ends. Butterfly valves shall be Victaulic, Gruvlock, or Kennedy.

H. Globe Valves: Valves shall have bronze body, rising stem, composition disc, threaded ends for 200 pound W.O.G. and shall be Crane, No. 7; Stockham, B-13T; Nibco/Scott, T-211-W or Kennedy, Figure 97.

I. Angle Valves: Valves shall have bronze body, rising stem, composition disc, threaded ends for 200 pound W.O.G. and shall be Crane, No. 17; Stockham, B-222; Nibco/Scott, T-311-W or Kennedy, Figure 98.

J. Sprinkler Wet Pipe Alarm Valves: Valves shall be U.L. listed and shall be furnished with all standard trim including pressure gauges, by-pass, test valves, electric alarm pressure switch and main drain. Valve shall be cast iron or ductile iron, and all parts in contact with water shall be non-ferrous. Internal parts shall be replaceable without removal of valve from installed position. Valve shall be Victaulic Series 751, Central Sprinkler Model 'F', or equivalent by Viking, Grinnell, Automatic Sprinkler or Reliant.

K. Supervisory Switches: The valve for each sprinkler system shall be provided with a valve mounted switch capable of detecting motion of the valve from a full open position. Switches shall be Underwriters Laboratories listed and Factory Mutual approved. Switch shall be System Sensor, United Electrics, Potter or Viking.

L. Water Flow Switches: Water flow switches shall be line mounted vane type with retard. Switch shall consist of two single pole, double throw, snap action switches and an adjustable, recycling pneumatic retard, contained inside a general purpose die-cast housing. Switches shall be capable of either horizontal or vertical mounting, and shall be Underwriters Laboratories listed and Factory Mutual approved. Switch shall be System Sensor, United Electrics, Potter or Viking.

M. Electric Bell: Bell shall be 10” round red enameled steel bell 120 Volt A.C. electric motor. Bell shall be Potter-Roemer 6230 or equivalent by Viking, System Sensor or United Electrics.

2.07 COMPRESSED AIR SYSTEM:

A. Pipe and Fittings: Schedule 40 galvanized steel pipe, ASTM A120, with screwed joints and 150 pound threaded malleable iron fittings, conforming to ASTM A47, shall be used for all compressed air piping.

B. Threaded joints shall be made with a mixture of graphite and oil applied to male threads only. After cutting but prior to threaded, pipe shall be reamed and shall have burrs removed.

C. A globe valve and union shall be provided at pipe connections to all equipment.

1. Grooved End Fittings: Fittings shall be ductile iron (ASTM A536); forged steel (ASTM A234); or fabricated from carbon steel pipe (ASTM A53); with pre-grooved ends for use with mechanical couplings of the same manufacturer.
2. Mechanical Couplings: Coupling housings shall be ductile iron (ASTM A536). Bolts and nuts shall be carbon steel track-type (ASTM A183), minimum tensile 110,000 psi. Gaskets shall be Grade “E” EPDM, for oil-free air, or Grade “T” Nitrile for air with oil vapors. At joints allowing controlled movement, expansion, contraction of deflection, flexible couplings with shall be used. At all joints not requiring flexibility, a rigid coupling shall be used.
   a. Rigid Type: Coupling housings cast with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with NFPA 13.
   b. Flexible Type: Use in locations where vibration attenuation and stress relief are required.
3. Flange Adapter: Flat face, for direct connection to ANSI Class 125 or 150 flanged components.

2.08 SPRINKLER HEADS:

A. Sprinkler heads shall be glass-bulb type. Body shall be die cast brass, with hex-shaped wrench boss cast into the body to facilitate installation and reduce the risk of damage during installation.

B. Upright sprinkler heads shall be ½ inch spray type with bronze finish. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

C. Pendent sprinkler heads unless otherwise indicated pendent sprinkler heads shall be quick response ½ inch spray type with chrome plated finish and white escutcheon plate. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

D. Dry Pendent sprinkler heads shall be ½ inch recessed type with polished brass finish. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

E. Sidewall sprinkler heads shall be quick response ½ spray type with chrome plated finish and white escutcheon. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

F. Concealed pendent sprinkler heads shall be ½ inch spray type with chrome plated finish and white escutcheon and ceiling plat. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

2.09 HANGERS FOR FIRE PROTECTION PIPING:

A. Hanger for 4" and larger horizontal lines shall be Clevis type hangers, B-Line B-3100 or equivalent by Anvil, or Erico.

B. Hanger for horizontal lines up to 3½" shall be band type hangers, B-Line Model B-3172 or equivalent by Anvil, or Erico.

C. Supports for vertical lines passing through floor shall be riser clamp type, Fee & Mason Fig. No. 241, Carpenter and Patterson No. 126 or equivalent by B-Line, Anvil or Erico.

2.10 FIRE DEPARTMENT CONNECTION:

A. The fire department connection shall be a Two way wall mounted type with clappers, caps and chains, and identification base plate. Finish shall be polished brass. Fire department connections shall be Potter Roemer Model 5751 or equivalent by Elkhart or Sierra.

PART 3. - EXECUTION

3.01 GENERAL:

A. Unless specifically stated otherwise, the fire protection system shall conform to all other sections of this specification which apply to pipe installation, accessories and controls.

B. All threaded hose outlets shall comply with the local fire department requirements.

C. All shop drawings submitted on items requiring Underwriters' Listing shall bear evidence of Underwriters' approval.

D. All exposed fire system piping including valve room piping shall be cleaned of rust, grease and scaled and shall be provided with a field applied prime coat and two coats of an oil based enamel paint. Color shall be red or as directed by architect.

E. The contractor shall perform all tests of Fire Protection Systems as required by governing codes and local authorities at no additional cost to the Owner. Tests shall be performed in the presence of the Owners representative.

3.02 INSTALLATION:

A. Install sprinkler piping with a slope to valve room and to auxiliary low point drains as required by NFPA 13.

B. Coordinate sprinkler installation with building structure and other trades.

C. Route alarm valve drains to outside building and terminate 9" AFG.

D. Verify locations of lights and diffusers prior to installing sprinkler heads and piping.

E. Sprinkler heads shall be installed on centerline with lights, diffusers and doors, in living units. In laying tile ceiling the sprinkler heads shall be installed in the center of 2' x 2' tiles and in the center of the ½ tile in 2' x 4' tiles.

F. Contractor shall purge air from all wet pipe sprinkler system piping prior to final system completion.

G. Provide return bends in heated areas in order to allow for adjusting heads to centerline.

H. Install a spare sprinkler cabinet near the sprinkler riser. Provide number of spare sprinklers as required by NFPA-13, with at least one spare for each type of head installed.

END OF SECTION 212010

SECTION 220500 - GENERAL REQUIREMENTS, PLUMBING

PART 1. - GENERAL

1.01 WORK INCLUDED

A. This section is applicable to and a part of all Division 22 sections of the Project Manual.

1.02 QUALITY ASSURANCE

A. Publications

1. Copies: Obtain copies of trade association standards and publication wherever needed for proper execution of the work.
2. Publication Date: Comply with the issue of applicable standard or publication which is in effect at the date shown on these contract documents. Obtain approval from the Architect-Engineer to comply with a later issue of a standard or publication.
3. Conflicting Requirements: Report to the Architect-Engineer where application of a trade association standard or publication appears to be in conflict with the requirements of the contract documents.

B. Product Standards: Listed in the current edition of UL "Electrical Construction Materials Directory," if such a listing exists for the particular type of item specified.

C. Reference Standards:

1. Meet or exceed the recommendations and requirements of reference standards.
2. Submit proof (stamp, label, published listing or independent certified test).

D. Servicing: Provide products supported by a service organization that is reasonably convenient to the site.

E. Nameplates:

1. Securely attach to each major component of equipment, visible and readable, name, address, and model identification number on a plate.
2. Do not cover with paint, insulation, or other material.

F. Manufacturer's Instructions: Follow the manufacturer's published instructions in preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated by the Contract Documents.

G. Capacities: Meet or exceed capacity requirements indicated. Stay within maximums, minimums and other limits. Prevent components or systems from becoming inoperative or damaged because of start-up, overload, or other conditions.

H. Suitability: Provide products suitable for the pressures, temperatures, fluids, voltages, environmental conditions, and other conditions encountered by the indicated application.

I. Protection from Moving Parts: Provide enclosures and guards for belts, pulleys, chains, gears, couplings, projecting set-screws, keys, hot surfaces and other hazardous parts located where persons can come in close proximity.

J. Spare Parts Data: Provide spare parts data prior to Substantial Completion.

K. Standard Products: Provide standard cataloged products of manufacturers regularly engaged in the manufacture of products that essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years.

L. Connections to Utilities:

1. Provide the services of a person or company approved by the respective utility authority to make connections to:
   a. Water supplies.
   b. Sanitary sewer.
   c. Storm sewer.
   d. Gas.
   e. Electrical power.
   f. Telephone.
   g. Other utilities.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

C. Submittals:

1. **Plumbing Product Data Submittals to be organized and submitted as ONE complete submittal** as follows (excludes shop drawings):
   a. Cover Sheet listing project name, date, GC, Subcontractor
   b. Index Sheet
   c. The contractor shall include a formal letter to the engineer, included in the submittal after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   d. Organize all required items by numerical specification section with tabbed dividers including section number and title. Each section to provide a subsequent index cover.
   e. Submittals not organized as indicated above may be rejected without review.
2. The contractor may require his subcontractors to provide coordination drawings indicating all trades, such drawings will not be reviewed by the engineer.
3. Unless agreed upon with the engineer, electronic submittals are not acceptable.
4. Shop drawings are to fully drawn/designed and coordinated by the contractor. Any replication of original bid documents will be rejected.

D. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract.
   b. Approved fixture/equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   e. Any and all data and/or plans required during construction.
   f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
   g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

E. Training:

1. Upon completion of the work and at a time designated by the Owner’s representative, provide a formal training session for the Owner’s operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner’s representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner’s representative and Engineer as a condition of final acceptance.

F. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

G. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered

separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.

2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle products carefully to prevent internal component damage, breaking or denting.

B. Store products in clean, dry space, protected from dirt, fumes, water, construction debris and physical damage.

C. Do not install damaged equipment or materials.

1.05 PRODUCT APPLICATION, INSTALLATION, AND OPERATION

A. General: For products incorporated into the Work, the Contractor shall ascertain the following:

1. Application:
   a. The manufacturer's representatives have reviewed the proposed application of their products.
   b. The application and product are compatible regarding:
      (1) Operation.
      (2) Electric Source.
      (3) Piping.
      (4) Controls.
      (5) Location.
      (6) Proximity to other products and elements of the work.
      (7) Structural support and integrity.
      (8) Other pertinent factors.

B. Installation: The installers were instructed in the manufacturer's recommended procedure for installation, and the product was installed according to the manufacturer's recommendations.

C. Operation: The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up, the products are operating as intended by the Contract Documents, and the application and product are compatible regarding the same factors named above.

D. Installation: Submit letter following installation of the manufacturer's product stating the following:

1. The installers were instructed in the manufacturer's recommended procedure for installation.
2. The product was installed according to the manufacturer's recommendations.

E. Operation: Submit letter with Owner's final documents stating the following:

1. The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up.
2. The products are operating as intended by the Contract Documents.
3. The application and product are compatible regarding the same factors named above.

F. Signature on Letter: By manufacturer's representative

PART 2. - PRODUCTS

Not Used

PART 3. - EXECUTION

3.01 TESTING

A. All plumbing systems shall be subject to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation regardless of the season.

B. All new plumbing systems shall be operated separately and coincident with other systems for a period of time to demonstrate to the satisfaction of the Owner, Engineer and Architect the ability of the equipment to meet capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications.

C. Make adjustments as required to ensure proper functioning of all systems.

D. Additional specific tests on individual systems are specified under individual sections of the specifications.

END OF SECTION 220500

SECTION 220501 - BASIC MATERIALS AND METHODS, PLUMBING

PART 1. - GENERAL

1.01 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with work similar to that required for this project.

C. NEC Compliance: Comply with the National Electric Code, NFPA 70.

D. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

1.02 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit the following Product Data, Shop Drawings, and Samples.

Item	Prod Data	Shop Dwgs	Samples
Access doors	X		
Motors	X		
Motor disconnects	X		
Motor controllers	X		
Foundations			
Roof and deck penetrations	X		
Sleeves	X		
Floor and ceiling plates	X		
Cutting and patching	X		

C. Include manufacturer's instructions for each product with submittal.

D. Submit reports and other documents as required.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle products carefully to prevent internal component damage, breaking or denting.

B. Store products in clean, dry space, protected from dirt, fumes, water, construction debris and physical damage.

C. Do not install damaged equipment or materials.

PART 2. - PRODUCTS

2.01 ACCESS DOORS

A. **AD1** Access Door (Paintable, flanged): If not otherwise accessible, provide a thin-flanged, framed access door, minimum of 10" square or adequate to service the device, secured by

vandal-proof screws, steel construction, primed for field painting as specified in Section: PAINTING; **Smith 4760**.

B. **AD2** Access Door (Stainless steel, flanged): If not otherwise accessible, provide a thin-flanged, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, 18-8 stainless steel construction with No. 4 finish; **Smith 4762**.

C. **AD3** Access Door (Paintable, flush): If not otherwise accessible, provide a flush-with-wall, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, steel construction, primed for field painting as specified in Section: PAINTING; **Smith 4765**.

D. **AD4** Access Door (Stainless steel, flush): If not otherwise accessible, provide a flush-with-wall, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, 18-8 stainless steel construction with No. 4 finish; **Smith 4767**.

E. Secure doors with the following:

1. In janitors closets, mechanical rooms, storage rooms, and other places not accessible to the public; Phillips-head screws, stainless steel or bright chromium plated.
2. Phillips-head screws, stainless steel or bright chromium plated.
3. Other locations: Secure doors with cylinder key lock, all keyed alike. Furnish minimum of one key per door.
4. Other locations: Secure doors with vandal-proof screws.

2.02 MOTORS

A. General: Provide electric motors selected and furnished by the suppliers or manufacturers to accommodate equipment, machines, and other products requiring drivers.

B. Classification: Where classification is specified, comply with NEMA MG 1-1972, "Motors and Generators."

C. Characteristics, Ratings: Where speed, horsepower, electrical characteristics, service factor, frame type is specified, comply with NEMA MG 1-1972, "Motors and Generators."

D. Installation: Install motor on suitable base, connect to the driven item, align and connect couplings, pulleys, and other driven items.

E. Provide energy-efficient motors complying with the following schedule:

HP	Efficiency	% Power Factor
1	82	84
1-2	83	85
2	84	85
3	85	86
5	87	87
7-2	88	87
10	89	88
15, 20	90	88
25	91	88

PART 3. - EXECUTION

3.01 ACCESS DOOR INSTALLATION

A. Install access doors in places where controls, valves, electrical junction boxes, and other devices and fittings that have serviceable or adjustable elements, or otherwise require access.

B. Type to Install:

1. Painted Walls (concrete block, drywall, plaster, other painted walls): Paintable Flanged (AD1), Paintable Flush (AD3).
2. Other Walls (glazed brick or tile, washable surface, outdoors or otherwise exposed to high humidity): Stainless Steel Flanged (AD2), Stainless Steel Flush (AD4).
3. Provide flanged type unless otherwise indicated to be flush type or if other elements in the same wall are flush type.

3.02 COORDINATION

A. General: Coordinate the configuration, location and arrangement of various products and systems to avoid conflict with other products.

B. Precedence: Give precedence to sloping of pipe for drainage and to electrical bus duct for minimizing offsets

C. Clearances: Maintain clearances at heated surfaces and at electrical raceway.

D. Exposed Work: Keep as close as practical to walls, ceilings, columns, and other elements of the Work so as to take up the minimum amount of space.

E. Common Hangers and Supports (Trapezes): Use wherever practical.

F. Alignment: Align piping and raceways of various systems.

G. Work in Ceilings: Follow reflected ceiling plans (both Contract Documents and Shop Drawings) for layout of Work in ceilings.

H. Thermostats and Electrical Devices on Walls and Floors: Coordinate height above floor and spacing when within close proximity of each other.

3.03 CLEANING AND PAINTING

A. General: Painting is specified in Section: PAINTING.

B. Cleaning: Clean surfaces to be painted of rust, oil, grease, mortar, construction rubble and other foreign substances.

C. Paint accessible ferrous metal (excluding corrosion resistant metal), regardless of whether exposed or concealed behind ceilings, shaft enclosures or similar construction, including uncovered pipes, frames, supports, and other ferrous elements.

1. Remove rust and scale by sand blasting and wire brushing.
2. Clean with solvent and apply a treatment of phosphoric acid.
3. Apply a primer coat of red oxide pigmented alkyd ferrous metal primer, 1.5 mil thickness.
4. Apply two (2) coats of gloss alkyd enamel in accordance with Federal Specification TT-E-489 of a color selected by the Architect-Engineer, 3.0 mil 2-coat thickness.

D. Paint interior and exterior exposed zinc-coated (galvanized) metal surfaces.

1. Clean surface with solvent and treat with vinyl-type wash coat.
2. Apply a first coat of zinc dust-zinc oxide primer (Fed Spec TT-P-641G, Type II), and a second coat of oil base exterior paint, color as selected by Architect-Engineer.

E. Paint only in the following areas:

1. Where indicated on the Drawings or elsewhere.
2. Outdoors.
3. Non-ventilated spaces beneath buildings.
4. Commercial kitchen hoods.
5. Showers.
6. Other high-humidity areas.

F. Factory Finishes: Items factory furnished with a finish coat of paint need not be painted unless a special finish or color is specified.

G. Damaged Finishes: Repair finishes of new and existing materials which have been damaged.

H. Do not paint nameplates on equipment; sliding or rotating shaft surfaces; non-ferrous hardware, accessories, trim; and similar items where painting would normally be omitted.

I. Identification: See Section: PLUMBING IDENTIFICATION.

3.04 ROOF AND DECK PENETRATIONS

A. Vent pipes projecting through the roof or waterproof deck: See Section: PLUMBING.

B. Pipes and Ducts Passing Through Roof:

1. Built Up Roofing:
   a. Provide sleeves, pitch pans, and flashing compatible with the roofing system.
   b. Extend pitch pan and pitch pocket bases 12" in each direction.
   c. Extend pitch pan and pitch pocket 6" above the roof flood line.
   d. Flash into the roofing waterproofing.
   e. Fill pitch pans and pitch pockets with hot poured roofing compound.
2. Metal Deck Systems and Other Proprietary Roofing Systems: Provide products manufactured by and methods approved by the roofing system supplier.
3. Submit shop drawings approved by the roofing supplier.

C. Submit Shop Drawings. Coordinate with Roofer.

3.05 ELECTRICAL

A. Connections: See Division: ELECTRICAL.

B. Disconnects and Motor Controllers (Starters): Provide as specified in Division: ELECTRICAL, except where such controllers or devices are part of or integral to or within equipment or are otherwise indicated.

C. Protection: Where motor is not internally protected or has no controller indicated elsewhere, provide NEMA-rated, heater-protected magnetic motor controllers; if motor has no requirement for automatically controlled starting and stopping, provide NEMA-rated, heater-protected manual motor controller.

3.06 SLEEVES

A. Location: Provide sleeves for pipes, conduits, and other service lines exiting, entering, or passing through walls, roof or floors where placement of pipes, conduits and other service lines must be subsequent to construction of walls, roofs or floors.

B. Set plastic thimbles in form-work where sleeves are required or indicated through poured-in-place concrete; do not cut through concrete for sleeves.

C. Shop Drawings: Show sleeves and sleeve type.

D. Interior Walls and Floors: PVC pipe, Schedule 40, flush with walls minimum 1/4” and maximum of 1” clearance packed with foamed urethane rods.

E. Exterior Walls and Floors, Below Grade: PVC pipe, Schedule 40, flush with walls, :" above floors, cast in place. Fill annular ring with **Link-Seal** bolted rubber link type sleeve seal, installed as recommended by manufacturer, electrically isolating the metallic pipes from the structure.

F. Through membrane: Provide membrane clamping fitting, threaded or caulked.

G. Insulation:

1. On Pipe and Duct Below 65 deg F and Over 180 deg F:
   a. Provide 16-gauge galvanized sleeve over insulation at sleeves through exterior walls and caulk the joint both sides of wall.
   b. Seal transverse joints in insulation at wall surface.
2. On Pipe and Duct 70□ F to 180□ F:
   a. Discontinue at penetration.
   b. Seal insulation both sides of wall.
   c. Provide sleeve as specified above.

H. Through Roofs: See Paragraph: ROOF AND DECK PENETRATIONS.

3.07 FLOOR AND CEILING PLATES:

A. Provide chrome or galvanized steel escutcheons for exposed pipes exiting, entering, or passing through floor, ceiling or walls.

B. Plates in finished rooms or over plated pipe: Polished chromium plated brass.

3.08 CUTTING AND PATCHING

A. Bore, drill, saw, and otherwise provide openings for piping, ducts, sleeves, and other elements of the mechanical systems.

1. In Masonry: Use drills, core drills, or masonry saws; do not use impact equipment unless requested and approved by the Architect-Engineer.
2. Pre-Cast Concrete: Use drills, core drills, or masonry saws; do not use impact equipment unless requested and approved by the Architect-Engineer. Cut to exact size; submit shop drawing for approval.
3. With Tensioned Cable Reinforcing in Concrete:
   a. Submit shop drawings of proposed locations and method of cutting.
   b. Do not proceed until shop drawings are approved.
   c. Do not cut cable reinforcing.

4. Poured-in-Place Concrete: Provide thimbles as specified in Paragraph: SLEEVES. Where indicated or otherwise Approved, cut same as indicated above for Pre-Cast Concrete; submit Shop Drawings.
5. Wood, Metal, Plastic, Pre-formed Boards: Drills or saws.
6. Other Substrates: Submit shop drawings.

B. Patching: Restore material surrounding the cut opening to as-new condition. Match remaining surrounding materials and finishes. Provide escutcheons as specified in Paragraph: FLOOR AND CEILING PLATES.

C. Roof Penetrations: Provide sleeves, pitch pans, and flashing compatible with the roofing system. Submit shop drawings approved by the roofing supplier. See Drawings for details.

3.09 IDENTIFICATION

A. See Section: PLUMBING IDENTIFICATION.

3.10 TESTING AND INSPECTION

A. Perform all tests specified in Division 22, or as required by the Engineer or by the Local, Federal, and State Bureaus or Agencies having jurisdiction and under the supervision during the progress and upon completion of the work.

B. Include all costs for tests in your bid or proposal.

C. Provide all apparatus, temporary systems or components and all other requirements for satisfactory completion of the test.

D. Take all due precautions to prevent damage to the building or to its components and contents incurred by such tests as the Contractor will be responsible for any and all damages. The Contractor will be required to repay and make good any damage so caused at his own expense.

E. Contractor shall immediately repair any leaks, defects or deficiencies discovered as a result of these tests. Repeat unit test requirements are in full compliance.

END OF SECTION 220501

SECTION 220529 - FOUNDATIONS, HANGERS, AND SUPPORTS, PLUMBING

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work to be included in this section is as follows, but is not limited thereto:

1. Hangers and supports for piping and equipment.
2. Concrete supports for piping and equipment.

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of equipment of this type whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with work similar to that required for this project.

C. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

D. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS) Standards: Provide hangers and supports that comply with the following MSS Standards: SP-58

E. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

F. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract.

b. Approved fixture/equipment brochures
c. Copies of approved Shop Drawings
d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
e. Any and all data and/or plans required during construction.
f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

G. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

H. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

I. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.03 SUBMITTAL

A. Submit manufacturer's technical product data including capacity ratings and application recommendations.

B. Shop Drawings:

1. Submit drawings indicating:
   a. Dimensions and loadings.
   b. Layout.
   c. Mountings and supports.
   d. Spatial relationship to associated equipment and nearby barriers.
2. Submit shop drawings of concrete bases and foundations.

PART 2. - PRODUCTS

2.01 CONCRETE FOUNDATIONS (PADS)

A. Pour concrete foundations (pads) for the support of equipment such as floor-mounted panels, pumps, fans, etc., not less than 4" high and extended 6" beyond all sides of the mounted equipment unless otherwise noted. Provide forms built of new-dressed lumber. Neatly chamfer corners of the foundations:" wide by means of sheetmetal or triangular wood strips nailed to the form. Place foundation bolts in the forms when the concrete is poured, correctly locating the bolts by means of templates. Set each bolt in a sleeve of size to provide 2" clearance around it. Allow 1" below equipment base for alignment and grouting. After grouting, remove the forms and hand rub the surface of the foundations with carborundum. Provide foundations for equipment located on the exterior of the building as indicated. Submit shop drawings of the foundations for review.

2.02 PIPE SUPPORTS, HANGERS, INSERTS, ANCHORS, AND GUIDES

A. General: Provide pipe supports, hangers, inserts, anchors and guides for all vertical and horizontal piping; comply with ANSI B31.1 Code for Pressure Piping and conform to MSS SP-58 and SP-69, except as specified below.

B. Finish: ASTM A164-71, 0.0005" electro-galvanizing plus gold zinc dichromate barrier formed on the zinc; finish type RS for threads, type LS for all other.

C. Inserts: Type 18.

D. Hangers: Type 1, 9, 10, or 11, adjustable or provided with turnbuckles, Type 13 or 15. Type 6 hangers may be used to support pipes from toilet rooms to main stacks when space does not permit the use of turnbuckles or adjustable clevis type hangers.

E. Light Duty Clevis Hangers: Conform to NFPA No. 13.

F. Brackets for Support of Piping at Walls: Type 31, 32, 33, or 34.

G. Slide Plates: Provide metallic pipes supported on beams or brackets with a graphite or polytetrafluoroethylene (PTFE) slide plate and cradle having a minimum thickness of 2"; Type 35.

H. Beam Clamps: Types 20, 21, 22, 23, 28, or 29. Provide a retainer with Type 23.

I. Angle Iron or Channel Clamps: Type 20 with a malleable iron heel plate added.

J. Provide auxiliary steel required for supports, anchors, guides, and other similar devices in addition to what is indicated on the Drawings or is specified here or elsewhere.

K. Review Drawings, including Structural Drawings, for details regarding pipe supports, anchors, hangers, and guides.

L. Provide pipe supports of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

M. Rod sizes indicated are minimum sizes only. Maintain structural integrity of all supports, anchors, guides, and other similar devices. Provide structural hanging materials with a safety factor of 5.

N. Locate and construct anchor points indicated on Drawings or as required to permit the piping system to take up its expansion and contraction freely in opposite directions, away from the anchored points.

O. Construct and locate guide points wherever required or indicated on drawings and at each side of an expansion joint or loop, to permit free axial movement only.

P. Fasten pipe supports, hangers, anchors and guides to the structure only at points where the structure is capable of restraining the forces in piping system.

Q. Isolate copper or brass lines from ferrous metals with c" thick sheet polyethylene dielectric material.

R. Provide other special types of foundations, hangers, or supports where so specified or indicated on the Drawings, or where required by the particular conditions; submit shop drawings for approval.

S. Properly size each hanger to fit the supported pipe or to fit the outside of the insulation on insulated lines.

1. Hangers for dual or low temperature insulated pipes: bear on the outside of the insulation.
2. Protect the insulation at bearing point from crushing by galvanized steel shields circling a minimum of 1/2 the insulation and extending a minimum of 6" on each side of the hanger.
3. Provide a rigid section of insulation to be installed at hanger points.
4. Encase hangers for high temperature and all insulated hot and cold domestic water pipes in the insulation unless supported by trapezes.
5. Where supported by trapezes, provide shield and rigid insulation as specified above for low temperature insulated pipes.
6. Provide shield gauges as follows:

Pipe or Insulation Diameter	**USS Gauge**
Up to 3"	No. 22
3" thru 6"	No. 16
Above 6"	No. 12

T. Hanger Rods:

Pipe Size	Rod Diameter
4" and smaller	3/8"
5" thru 8"	1/2"
10" thru 12"	5/8"
14" thru 16"	3/4"

U. Supports for vertical piping: Type 42 double bolt riser clamps with each end having equal bearing on the building structure; locate at each floor.

V. Supports on Vertical Surfaces for Horizontal Piping: Type 24 U-bolt on drilled steel channel (or manufacturer's proprietary 2-piece snap-in bolted product). Use only to support pipe from vertical surfaces or members where lines are not subject to expansion or contraction.

W. Do not use perforated strap or ferrous wire for hanger material.

X. Isolate copper or brass lines from ferrous metals with dielectric material to prevent corrosion.

Y. Type 2, Floor-Mounted Equipment

1. Vibration isolators shall be free standing, unhoused, laterally stable springs wound from high strength spring steel. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections shown on the Vibration Isolation Schedule or as indicated on the project documents. Springs shall be color coded or otherwise identified to indicate load capacity. In capacities up to 5,000 lbs., springs shall be replaceable. In capacities over 5,000 lbs., springs shall be welded to the top and bottom load plate assemblies. Springs shall be assembled between a top and bottom steel load plate. The upper load plate shall be provided with a steel leveling bolt lock nut and washer for attachment to the supported equipment. The lower load plate shall have a non-skid noise isolation pad bonded to the bottom and have provisions for bolting the isolator to the supporting structure.
2. Spring isolation mounts for floor-mounted equipment shall be Model FDS, as manufactured by Kinetics Noise Control.

2.03 PIPE SUPPORTS, HANGERS, INSERTS, ANCHORS, AND GUIDES (PLASTIC PIPING)

A. General: Same as for metal except: **Hangers: Vee Bottom Clevis Hanger, adjustable or provided with turnbuckles, B-Line Systems with Plastic Pipe Support Channel.**

2.04 PIPE SUPPORTS IN CHASES AND PARTITIONS

A. Support horizontal and vertical piping in chases and partitions by hangers or other suitable support.

B. Securely support pipes serving plumbing fixtures and equipment near the point where the pipes penetrate the finish wall.

C. Provide supports of steel plate, angles or special channels such as Unistrut mounted in vertical or horizontal positions.

D. Attach pipe clamps such as **Unistrut P2426, P2008, P1109** or other approved clamps to supports.

E. Attach supports to wall or floor construction with clip angles, brackets, or other approved method.

F. Supports may be attached to cast iron pipe clamp, No. 9 black soft annealed wire, or other approved method.

PART 3. - EXECUTION

3.01 ATTACHMENT

A. Do not exceed the safe and allowable load and spacing on any hanger, insert, or any component of the support system, including the substrate and the concrete which holds the inserts. Provide reinforcement at inserts as required to develop the necessary strength.

B. Provide inserts for piping supports of a type which will not interfere with reinforcing and which will not displace excessive amounts of structural concrete. Do not interfere with reinforcing.

C. Design and install pipe support to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, and other similar devices.

D. Install piping with due regard for expansion and contraction, the type of hanger, method of support, location of support, and other similar circumstances.

E. Attach pipe hangers to the structure as follows:

1. **Refer to structural drawings for additional support requirements.**
2. Poured in place concrete:
   a. Where pipes and equipment are supported under poured in place concrete construction, fit each hanger rod with a nut at its upper end, set into an Underwriter's Laboratories, Inc., listed universal concrete insert placed in the formwork before concrete is poured.
   b. Where inserts are placed in the bottom faces of concrete joists which are too narrow to provide adequate strength of concrete to hold the insert properly or where a larger insert would require displacement of the bottom joist steel, suspend the hanger rod from the center of a horizontal angle iron channel, iron I-beam, or other similar device, spanning across two adjacent joists.
   c. Bolt the horizontal support to non-adjustable concrete inserts of the "spot", type, of physical size small enough to avoid the bottom joist steel.
3. Poured-in-Place Joists: Same as above except do not install inserts.
4. Steel Beams:
   a. Where pipe and loads are supported on steel beams, use approved type supports.
   b. Where pipe and loads are supported under steel beams, use approved type beam clamps.
5. Wood Framing: Where pipe and loads are supported from wood framing, attach hanger rod to framing with side beam brackets or angle clips.
6. Precast Double Tee Structural Concrete:
   a. Install hangers, supports, anchors, and other similar devices required for mechanical systems attached to the precast, double tee, structural concrete system in accordance with approved shop drawings only.
   b. Core drill holes required for hanger rods in the "flange" of the double tee only; do not use impact type tools. Do not core drill in the "stem" portion of the double tee.
   c. Core drill holes through the "flange" for hanger rods no greater than 3" larger than the diameter of the hanger rod.

d. Support hanger rods by means of bearing plates of size and shape acceptable to the Architect-Engineer, with welded double nuts on the hanger rod above the bearing plate.
e. Cinch anchors, lead shields, expansion bolts, and studs driven by explosive charges are not allowed under any circumstances in the lower 15" of each stem and in the "shadow" of the stem on the top side of the "double tees".

7. Other Already-Hardened Concrete: Submit Shop Drawings.

3.02 SPACING

A. Locate hangers supporting horizontal lines to prevent appreciable sagging of these lines.

B. Support cast iron lines with hangers spaced 5'-0" on centers, with a minimum support of one hanger per joint or fitting.

C. Support pipes in accordance with ANSI B31.1.

D. The following table gives maximum hanger spacing for copper and steel lines.

Size of Line	**Hanger Spacing, Feet**
¾" and smaller	6
1" thru 1-½"	8
2" thru 2-½"	10
3" and larger	12

E. Space hangers more closely where required by the conditions of the installation in order to prevent sagging, excess load on structures and hangers, undue strain on equipment, noise transmission, and other similar circumstances.

F. Place a hanger within 2' of each elbow or tee.

3.03 TRAPEZES

A. Where multiple lines are run horizontally at the same elevation and grade, support on trapezes made by **Kindorf, Elcen** or equal, channel suspended on rods or pipes.

B. Properly size trapeze members including suspension rods for the number, size, and loaded weight of the lines they are to support.

3.04 MISCELLANEOUS

A. Do not use chain straps, perforated bars or straps, wire hangers, or expansion shields.

B. Use UL listed hangers and supports for fire standpipe systems and fire sprinkler systems.

C. Provide any other foundations, hangers, and supports indicated on the Drawings, specified elsewhere within, or required by conditions at the site.

D. Provide hangers and supporting structures for suspended equipment as required to support the load from the building structure; submit shop drawings.

END OF SECTION 220529

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 220550 - PLUMBING EXCAVATION

PART 1. - GENERAL

All BACKFILL PROCEDURES AND MATERIALS SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT RECOMMENDATIONS.

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE:

A. Coordination: Where excavation and backfill for plumbing work passes through or occurs in the same areas as work specified in the Division 2 sections, comply with both the requirements of the Division 2 sections and the requirements of this section, whichever is the more stringent (as determined by the Architect/Engineer in cases of conflicting requirements).

1.03 JOB CONDITIONS:

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

PART 2. - PRODUCTS

2.01 BACKFILL MATERIALS

A. Subbase Material: A graded mixture of gravel, sand, crushed stone or crushed slag.

PART 3. - EXECUTION

3.01 EXCAVATING:

A. Inspection: The excavator must examine the areas to be excavated, and the conditions under which the work is to be performed and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with excavating until unsatisfactory conditions have been corrected in a manner acceptable to the excavator.

B. General:

1. Do not excavate until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimum.
2. Provide signs, illuminations and barricades as necessary to prevent accidents at excavations.
3. Excavate with vertical sided excavations to the greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at a sufficient distance below finished grade to not interfere with other work.

4. Excavate for piping with 6" to 9" clearance both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Provide a minimum of 12" clearance around underground tanks.
5. For work to be supported directly on undisturbed soil, do not excavate beyond required depths, and hand excavate the bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at the bottom of the excavations:
   a. Piping of 5" and less pipe/tube size.
   b. Cast-in-place concrete.
6. Where directed, excavate additional depth to reach satisfactory soil-bearing conditions. Backfill with subbase material compacted as directed, to indicate excavation depth.
7. Except as otherwise indicated, excavate for exterior water-bearing piping so that the top of piping will not be less than 2'- 0" vertical distance below finished grade.
8. Store excavated material (temporarily) near the excavation, in a manner which will not interfere with or damage the excavation or other work.
   a. Retain excavated material which complies with the requirements for backfill material.
   b. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirement for backfill material.

3.02 DEWATERING:

A. Maintain dry excavations by removing water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations from being damaged by water, sediment or erosion from or through excavations.

3.03 BASE PREPARATION:

A. Install subbase material to receive fire protection work, and compact by tamping to form a firm base for the work. For piping, shape the subbase to fit the shape of the bottom 90 degrees of the cylinder, for uniform continuous support.

B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanges connections, valves and similar enlargements in the piping systems.

3.04 BACKFILLING:

A. Do not backfill until installed work has been tested and accepted, wherever testing is indicated.

B. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

C. Backfill simultaneously on opposite sides of work, and compact simultaneously; do not dislocate the work from installed positions.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.

1.	Lawn/Landscaped Areas:	90%
2.	Roadways:	95%
3.	Paved Area, Other than Roadways:	95%

E. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

F. Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by the Architect/Engineer.

3.05 PERFORMANCE AND MAINTENANCE:

A. Where subsidence is measurable or observable at plumbing work excavations during the guarantee period, remove the surface (pavement, lawn or other finish), add backfill material, compact and replace the surface treatment. Restore the appearance, quality and condition of the surface or finish to match adjacent work and eliminate evidence of the restoration to the greatest extent possible.

END OF SECTION 220550

SECTION 220553 - PLUMBING IDENTIFICATION

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of the Work is indicated on the Drawings, and by the requirements of this section, and is hereby defined to include the following identification:

1. Hazardous material piping system identification.
2. Piping systems.
3. Piping system devices (valves, thermometers, pressure gauges, etc.):

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of equipment of this type whose products of this type have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with Work similar to that required for this project.

C. ANSI Compliance: Provide components conforming to ANSI A13.1.

D. Acceptable Manufacturers:

1. Seton
2. Brady
3. Kolbi

1.03 SUBMITTAL

A. Submit data indicated in Section: GENERAL REQUIREMENTS, PLUMBING.

B. Submit list of all products incorporated into the Work.

C. Submit the following Product Data, Shop Drawings, and Samples.

Item	Prod Data	Shop Dwgs	Sam-ples
Hazardous system markers	X		
Piping system color-coding	X		
Device tags	X		
Device charts	X		
Equipment labels	X		

D. Include manufacturer's instructions for each product with submittal.

E. Submit reports and other documents as required.

PART 2. - PRODUCTS

2.01 IDENTIFICATION PRODUCTS

A. Hazard Markers for Pipe-Conveyed Material:

1. Conform to ANSI A13.1 for classification of hazards of materials.
2. Use markers of the following colors to identify the materials conveyed by the pipes:

	Material	Field	Letters
a.	Inherently Hazardous:	Yellow	Black
b.	Inherently Low Hazard:		
	(1) Liquid or Liquid Admixture:	Green	White
	(2) Gas or Gaseous Admixture:	Blue	White
c.	Fire Quenching Materials:	Red	White

3. Provide pipe markers with the following features.
   a. Letters from 2" to 3" size letters to afford readability from the appropriate viewing position.
   b. Repeated and reversed words for viewing from 360 degrees around pipe.
   c. Self-clinging, coiled markers that snap into place around pipe and do not require any other securement.
   d. Integral directional arrows.
4. Letters on Field: Identify the specific material conveyed, e.g., "Domestic Cold Water", "Sprinkler", etc.
5. Model:
   a. Less than 1/2": Tags, same as Paragraph: Piping System Devices, color codes for hazard.
   b. 1/2" up to 6"; **Seton Setmark SNA** snap-on.
   c. Over 6"; **Seton Setmark STR** strap-on, with stainless steel spring straps.
6. Self-adhesive markers are acceptable if affixed at each end with minimum 2" overlapping plain or arrow tape.

B. Piping System Devices (Valves, Thermometers, Pressure Gauges, etc., and Pipe Less Than:"): Identify with the following.

1. Tags: Not less than 1-1/2" brass or aluminum tags, round, square, or octagonal.
2. Stamp tags with minimum 1/4" high descriptive characters, 1/2" high numbers, with black enamel-filled indentations.
3. Tag Model: **Seton 250-BL, 300-BL, SVT-15BL, SVT-20BL, OVT-20BL, or XVT-15BL**.
4. Attachment: Stainless steel or solid brass jack chain; **Seton JA16**, or stainless steel or brass "S" hooks; **Seton S10, S20, or S30**.

C. Equipment labeling:

1. Provide engraved, laminated plastic nameplates, 1/16" thick, 3-layer, white letters on black background, 3/16" letter height, beveled edges, drilled for 2- #3 screws.
2. Attach with corrosion-resistant self-tapping screws or corrosion-resistant pop-rivets.
3. Model: **Seton style 2060-20, 2062-25, 2060-30, 2060-40**.
4. At all Fire Damper locations, provide engraved, laminated plastic namesplates, 1/16" thick, red letters on white 1" tall background, ½" letter height, labels to be permanently fastened on ceiling grid below the damper. Label to read "FIRE DAMPER"

D. Underground Warning Tapes:

1. Provide materials that meet the codes or have the approvals listed below:
   a. Office of Pipeline Safety Regulation, USAS Code B31.8.
   b. GSA Public Building Service Guide Specification.
   c. National Transportation Safety Board Report NTSB-PSS-73-1.
   d. AGA Report 72-D-56.
   e. API Report API RP 1109.
2. Material: Plastic, continuous tape, color-coded, marked for hazard.

a. For Non-metallic Piping System: Aluminum foil core encased in plastic.
b. Metallic Piping: Plastic tape.

3. Color: Colored (not printed color) plastic, coded for material conveyed by piping.
4. Width: As scheduled for piping system burial depth.
5. Legend: "Caution [System Name] Line Buried Below".
6. Tape Colors:

Utility	**Color**
Electric	Safety Red
Gas, Oil, Dangerous Materials	Hi Visibility Safety Yellow
Communications	Safety Alert Orange
Water Systems	Safety Precaution Blue
Sewer Systems	Safety Green

7. Model:
   a. Metallic Piping System: **Allen Systems Markline**.
   b. Non-Metallic Piping System: **Allen Systems Detectatape**.

E. **Pipeline Markers for Pipe Beneath Pavement and Slabs**

1. Minimum 2" round, square, or octagonal, same as specified in Subparagraph: Piping System Devices.
2. Attachment:
   a. 1-1/2" screw, bolted to tag as anchor.
   b. Anchor Setting Compound: Epoxy or epoxy grout, compatible with the pavement.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Complete installation in accordance with ANSI A13.1 and manufacturer's installation instructions and with the Drawings. Fasten each unit securely in place.

B. Hazard Markers for Pipe-Conveyed Material:

1. Location:
   a. In crawl spaces.
   b. Where exposed beneath suspended slabs.
   c. Outside above grade.
   d. Above roofs.
   e. Above lay-in ceilings
   f. Other places where pipe is exposed in occupied rooms and spaces, indoors and outdoors.
2. Spacing:
   a. Where pipe passes through walls, floors, and other barriers.
   b. In Tunnel Vaults and Equipment Rooms: Maximum spacing, 10'; closer where piping is congested, and where piping continuity is obscured from view.
   c. Piping in Tunnels: Maximum spacing 100'.
   d. Other Places: Maximum spacing 50'.

C. Piping System Color Coding:

1. Designate for painter the following:
   a. Types of piping services.
   b. Direction of flow.
   c. Other information required for proper identification.

2. Surfaces to be Painted:
   a. Bare piping.
   b. Insulation covering of insulated piping.

D. Piping System Devices (Valves, Thermometers, Pressure Gauges, etc.):

1. Identify with the following information:
   a. System.
   b. Device number.
   c. Device function.
2. Device Chart:
   a. Key devices to device chart.
   b. Give complete description of device function and system.
3. Key devices to drawings as follows:
   a. Floor plans.
   b. Schematic drawings of piping systems.

E. Equipment labeling:

1. Install on scheduled items of equipment, including the following:
   a. Water heaters.
   b. Pumps.
   c. Control panels and major control components.
   d. Other items of equipment.
   e. Include Mark Number and descriptive name from Drawing and Specification schedules.

F. Underground Warning Tapes:

1. Tape Widths:

Piping Burial Depth	Tape Width
10"	2"
20"	3"
27"	6"
30"	9"
40"	12"
50" or more	18"

2. Recommended Tape Bury Depth:
   a. Minimum Depth: 6".
   b. Distance Between Pipe and Tape: Minimum 12".
   c. Maximum Depth: 12".
3. Tie tape to pipe where pipe leaves the ground.

G. Pipeline Markers for Pipe Beneath Pavement and Slabs.

1. Location:
   a. Accuracy: Plus, or minus 6" from piping center line.
   b. Flat Edge Pavement and Slabs: Set within 6" of pavement or slab edge.
   c. Concrete Curbs: Set in top of curb.
   d. Spacing: Each change in direction, each edge of pavement or slab, maximum spacing of 100'.
2. Legend: Same as tags plus an engraved or stamped line; set marker with line parallel to buried line.

3. Attachment: Drill hole for anchor bolt, full depth of bolt plus 2"; set full tag and bolt in epoxy, flush with pavement or slab.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1. - GENERAL

1.01 QUALITY ASSURANCE

A. Acceptable Manufacturers:

1. Fiberglass Insulation:
   a. Owens-Corning Fiberglass.
   b. Johns-Manville.
   c. Knauff.
   d. CertainTeed.
2. Urethane Insulation, flexible:
   a. Owens-Corning.
   b. Armstrong (Armaflex).
3. Urethane, Rigid (polyisocyanurate):
   a. Thermacor CTI.
4. Fiberglass Rigid-Flexible:
   a. SPI Rigidflex.
5. Mastics:
   a. Benjamin Foster.
   b. Insul-Coustic.
   c. Chicago Mastic.
   d. Childers Products.
6. PVC Fittings:
   a. Johns Manville
   b. Proto LoSmoke PVC.

B. Installer's Qualifications:

1. A company that has insulated a minimum of five similar projects of similar size and scope that have been in operation a minimum of two years.
2. Utilize only workers skilled in this trade to apply materials.

C. Apply materials only after substrate has been tested and cleaned.

D. Finish all insulation with material having a maximum flame spread rating of 25 under ASTM method 84.

E. Install non-compressible insulation material at hangers of cold piping to eliminate through-metal conductance.

F. Related Work: Sizing and paint, pipe shield or saddle, and internal duct insulation are specified in other Sections.

G. Vapor Barrier:

1. Provide minimum insulation thickness as scheduled, but sufficient to eliminate surface condensation on the cold-substrate insulation and to maintain a maximum exterior insulation surface temperature of 140^{o}F on the hot-substrate insulation.
2. Vapor-seal insulation of all substrates which operate below 60^{o}F.

1.02 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit the following Product Data, Shop Drawings, Samples, and manufacturer's certifications:

Item	Product Data	Shop Dwgs	Samples
Insulation	X		
Fitting covers	X		
Finishing materials	X		
Vapor barrier mastic	X		
Weather barrier mastic	X		
Adhesives	X		
Fittings, valves, and other irregular appurtenances	X X		 X

C. Include manufacturer's instructions for each insulation system with submittal.

D. Submit reports and other documents as required.

PART 2. - PRODUCTS

2.01 INSULATION TYPES

TYPE	K @	TEMP 75°F	LIMIT	SPEC COMPLIANCE	R*
1. Calcium silicate	.38	1200	11	ASTM C533, Type I	2.6
2. Cellulose fiber	.26	350	3	ASTM C739	3.8
3. Fiberglass (rigid)	.23	450	3	ASTM C612, Type 1 B	4.3
4. Fiberglass pipe covering	.23	850	3	ASTM C547 Type I	
5. Flexible fiberglass blanket	.24	250	1.5	ASTM C1071, Type I	8.3
6. Foamed glass	.40	850	9	HH-1-551	2.5
7. Foamed plastic, flexible	.25	220	5.8	HH-1-573B	4.0
8. High temperature	.23	850	3	ASTM C612, Type II	4.3
9. Insulating cement	.70	1700	34	SS-C-160	1.4
10. Mineral wool	.23	1000	8	ASTM C612	4.3
11. Not used.					
12. Polystyrene	.24	170	1	HH-1-524B	4.3
13. Urethane foam rigid	.14	220	2	HH-I-530a Grade 2 Type 1 Class 1	6.3
14. Fiberglass rigidflex	.27	850		ASTM C1393 Type IIIA	

*R-Value: Provide insulation with R-Value indicated unless other thickness indicated elsewhere.

2.02 FITTINGS

A. Fitting Types:

1. Molded, of same material as insulation.
2. Inserts, of same material as insulation.
3. Loose fill mineral fiber.

B. Fitting Covers:

1. Preformed PVC fitting covers with fiberglass inserts.

2. Preformed fitting covers of same material as pipe covering.
3. Job built fitting covers of similar material as pipe covering.
4. Preformed PVC fitting covers with molded or fitted inserts of same material as pipe insulation.

C. Removable Covers:

1. Glass fiber blanket, enclosed in vapor barrier for cold systems, covered with stiched 8 oz. fiberglass canvas.
2. Aluminum eyelets, cord lacings.
3. Resistant to temperatures of substrate.
4. Install on valves, strainers, and other servicing and servicable devices in both hot and cold systems.

2.03 INSULATION FINISHES (EQUIPMENT, PIPE, FITTINGS & DUCT)

A. Finishes:

1. 8 oz. fiberglass canvas.
2. Insulation cement.
3. 0.016” aluminum with aluminum bands.
4. 15 mil PVC.
5. 30 mil ABS.
6. 1/4" weatherproof mastic with glass mesh reinforcement.
7. 1/16" vapor barrier mastic with glass mesh reinforcement.
8. White all service jacket (ASJ) (vapor barrier), foil-kraft laminate, self-sealing lap (SSL); Fed.Spec. HH-I-1751/4, Grade 1 or 2.
9. Foil reinforce kraft jacket (FRK) (vapor barrier), self-sealing lap (SSL).
10. Insulation manufacturer’s paint finish tinted as selected by Architect-Engineer.
11. 0.016" stainless steel.

2.04 ADHESIVES AND MASTICS SUPPLEMENT

A. Vapor Barrier Mastics:

1. White, polymeric, UL classified vapor barrier mastic to seal fittings; **Foster 30-35 or Childers CP-30**.
2. Black, asphaltic, UL classified vapor barrier mastic; **Foster 65-05, 06 or Talcote 025**.
3. Black, asphaltic vapor barrier mastic for underground or outdoor use (not UL classified); **Foster 60-25, 26 or Talcote 070**.

B. Weather Barrier Mastics:

1. White, elastomeric, UL classified outdoor grade, vinyl mastic for finishing outdoor insulation; **Foster 35-00 or Childers CP-10**.
2. Black, asphaltic emulsion, breathing mastic for underground or outdoor use (not UL classified); **Foster 90-07 or Lion Oil Sealkote**.

C. Adhesives:

1. Water based, polymeric, UL classified lagging adhesive for applying glass cloth; **Foster 30-36 or Childers CP-50**.
2. Fast setting, rubber based, UL classified, vapor barrier lap and attachment adhesive; **Foster 85-15 or Childers CP-85**.
3. Same adhesive, except non-flammable when wet; **Foster 85-20 or Childers CP-82**.

4. Rubber based, UL classified, fast setting contact adhesive for adhering flexible cellular insulation; **Foster 82-40 or Armstrong 520**.

PART 3. - EXECUTION.

3.01 APPLICATION

A. General: Use mechanical fasteners whenever possible to assure permanent construction. Leave exposed insulation with a smooth, neat, paintable surface. Remove unsightly Work and replace with new materials.

B. Equipment:

1. Application:
   a. **E1**: Cut insulation to fit the contour of the equipment and secure by means of bands, stick clips, weld pins and lugs or adhesives as required for each individual piece of equipment.

C. Piping:

1. Application:
   a. **P1**: Butt insulation together; securely staple in place with outward clinching staples on 3" centers. Install factory furnished laps at the butt joints. Where insulation terminates, bevel and finish it neatly.
   b. **P2**: Butt insulation together; securely staple in place with outward clinching staples on 3" centers. Install factory furnished laps at the butt joints. Where insulation terminates, neatly bevel, apply vapor barrier mastic, and finish. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.
   c. **P3**: Butt insulation together and adhere in place with a contact cement. Where possible, slip tubing on without slitting. Where insulation terminates, neatly bevel and finish.
   d. **P4**: Butt insulation together and secure with mechanical fasteners. Fill all joints with insulation cement prior to insulation finish.
   e. **P5**: Butt insulation together and adhere in place with a contact cement. Maintain vapor barrier at joints equal to product's perm rating. Where possible, slip tubing on without slitting. Where insulation terminates, neatly bevel and finish.
2. Pipes Passing Through Sleeves:
   a. Continue insulation through the sleeve except at firewall penetrations.
   b. Provide an aluminum jacket with factory applied moisture barrier over the insulation wherever penetrations require sealing.
   c. Where Penetrating Interior Walls: Extend the aluminum jacket 2" beyond either side of the wall and secure on each end with a band.
   d. Where Penetrating Floors: Extend the aluminum jacket from a point below the backup material to a point 10" above the floor with one band at the floor and one not more than 1" from the end of the aluminum jacket.
   e. Where Penetrating Waterproofed Floors: Extend the aluminum jacket from below the backup material to a point 2" above the flashing with a band 1" from the end of the aluminum jacket.
   f. Where penetrating exterior walls: Continue the aluminum, jacket required for pipe exposed to weather through the sleeve to a point 2" beyond the interior surface of the wall.
3. Where Penetrating Roofs:

a. Insulate pipe as required for interior service to a point flush with the top of the flashing and sealed with vapor barrier coating.
b. Butt the insulations for exterior application butt tightly to the top of flashing and interior insulation.
c. Extend the exterior aluminum jacket 2" down beyond the end of the insulation to form a counter flashing.
d. Seal the flashing and counter flashing underneath with caulking.

D. Insulation at Pipe Sleeves: Provide complete pipe sleeve unit meeting the following requirements:

1. Manufactured unit consisting of pouring sleeve, fireproof insulation, and fireproof packing.
2. Unit designed to create a fire and smoke barrier where the pipe passes through walls and floors.
3. Unit Materials:
   a. Insulation: Calcium silicate, 100 psi compressive strength, asbestos-free, water repellant.
   b. Jackets, sleeves, and flanges: ASTM A527 galvanized steel.
   c. Packing: Ceramic fiber, temperature limit of 2,400^{o}F.
4. Unit passes ASTM E119 tests.
5. Unit complies with UBC STD. No. 43-1.
6. Suitable for substrate temperatures of minus 20^{o}F to plus 1,200^{o}F.
7. Where Penetrating Roofs:
   a. Seal the flashing and counter flashing underneath with caulking.
8. Model: **Pipe Shields Incorporated Series F**.

END OF SECTION 220700

See Insulation Schedule, following page(s).

	Exposed Non-Conditioned Area	Exposed Conditioned Area	Exposed to Outdoors	Concealed Non-Conditioned Area	Concealed Conditioned Area
1 FIRE PROTECTION SYSTEM, EXPOSED TO FREEZING, 1/2" TO 8"					
Insulation Type	3	3	6	3	3
Thickness, inches	1.5	1.5	2	1.5	1.5
Application	P2	P2	P3	P2	P2
Finish	8	8	Paint	8	8
Fitting Type	1	1	3	2	2
Fitting Finish	7&1	7&1	None	7	7
2 DOMESTIC COLD WATER (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	2	1	1
Application	P2	P2	P2	P2	P2
Finish	8	8	8&3	8	8
Fitting Type	1	1	2	2	2
Fitting Finish	7&1	7&1	7&3	7	7
3 DOMESTIC HOT WATER, HOT WATER RETURN (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1.5	1.5	1.5	1.5	1.5
Application	P1	P1	P1	P1	P1
Finish	8	8	8&3	8	8
Fitting Type	1	1	2	2	2
Fitting Finish	7&1	7&1	3	7	7
4 COOLING COIL DRAINS, CONDENSATE DRAINS (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	1	1	1
Application	P2	P2	P2	P2	P2
Finish	8&3	8&3	8&3	8	8
Fitting Type	2or3	2or3	2or3	2or3	2or3
Fitting Finish	7&3	7&3	7&3	7	7
5 PLUMBING P-TRAPS RECEIVING CONDENSATE DISCHARGE (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	1	1	1
Application	P2	P2	P2	P2	P2
Finish	8&3	8&3	8&3	8	8
Fitting Type	2or3	2or3	2or3	2or3	2or3
Fitting Finish	7&3	7&3	7&3	7	7

	Exposed Non-Conditioned Area	Exposed Conditioned Area	Exposed to Outdoors	Concealed Non-Conditioned Area	Concealed Conditioned Area
6 STORM WATER DRAINAGE – SD – ROOF AND OVERFLOW SYSTEMS (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	1-1/2	1	1
Application	P2	P2	P2	P2	P2
Finish	8&3	8&3	8&3	8	8
Fitting Type	2or3	2or3	2or3	2or3	2or3
Fitting Finish	7&3	7&3	7&3	7	7
All piping shall be insulated and insulate the roof and overflow drain (RD) sumps with sheet insulation as scheduled. Horizontal piping within crawl-space need not be insulated.					
7 HOT WATER EXPANSION TANKS (Fiberglass, rigid)					
Insulation Type	3				
Thickness, inches	1.5				
Application	P1				
Finish	6&1				
Fitting Type	2or3				
Fitting Finish	6&1				

END OF SCHEDULE

SECTION 221000 - PLUMBING PIPING AND APPURTENANCES

PART 1. - GENERAL

1.01 RELATED DOCUMENTS

A. Related documents are as follows:

1. Bidding Requirements, Contract Forms, Conditions of the Contract, and other Bidding Documents and Contract Documents.
2. Division 1 Sections and General Requirements, Mechanical.
3. Basic Materials and Methods, Mechanical.
4. Other sections of the specifications as applicable.

1.02 DESCRIPTION OF WORK

A. The extent of the Work is indicated on the Drawings, and by the requirements of this section, and is hereby defined to include the following:

1. Domestic cold and hot water piping.
2. Waste, drain, and vent piping.
3. Miscellaneous devices and equipment.
4. **Smoke Pressurization Testing of Waste system (By General Contractor)**
   a. Plumbing contractor to coordinate with the General Contractor's Third-Party testing firm.
5. **Camera TV Video Recording of all main Storm Drain and Sanitary Sewers in and under the Building (By General Contractor).**
   a. Plumbing contractor to coordinate with the General Contractor's Third-Party testing firm.

B. Make connections to the off-site utilities listed below. Make arrangements for these various connections with the respective utility agency. Pay connection charges and other charges to the agencies for utility connections, extensions, and other work related to the utility connections.

1. Water.
2. Sewer.
3. Gas.
4. Storm Drain.

C. On-site: Make connections to the on-site utilities listed below.

1. Water.
2. Sewer.
3. Gas.
4. Storm Drain.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with Work similar to that required for this project.

C. NEC Compliance: Comply with the National Electric Code, NFPA 70, as applicable to wiring and other electrical construction of the unit.

D. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

E. Comply with the minimum standards prescribed in requirements and recommendations of the latest edition of the following codes and standards:

1. Underwriter's Laboratories, Inc. Standards.
2. National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) Standard: National Standard Plumbing Code.
3. Uniform Plumbing Code (UPC).
4. International Plumbing Code (IPC).
5. NFPA 54, "Gas Appliances and Gas Piping."
6. Other codes, ordinances, and laws applicable to the place of the Work.

F. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. The Owner shall give notice of observed defects with reasonable promptness.
4. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

G. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract.
   b. Approved fixture/equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   e. Any and all data and/or plans required during construction.
   f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
   g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

H. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

I. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

J. Utilities, Locations and Elevations

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.04 SUBMITTAL

A. Submit data indicated in Section: GENERAL REQUIREMENTS, PLUMBING.

B. Submit list of and Product Data for all products incorporated into the Work.

C. Submit the following Product Data, Shop Drawings, and Samples.

	Item	Prod Data	Shop Dwgs	Sam-ples
1.	Piping materials.	X		
2.	Clean-outs.	X		
3.	Roof drains.	X		
4.	Floor drains.	X		
5.	Water-hammer arresters.	X		
6.	Hose bibs.	X		
7.	Wall faucets.	X		
8.	Lawn faucets.	X		
9.	Backflow Preventer.	X		
10.	Cathodic Protection.	X		
11.	Pumps.	X		
12.	Trench Drains.	X		
13.	Neutralization Basin.	X		
14.	Gas Pressure Regulators.	X		
15.	Venting System for Combustibles.	X	X	
16.	Trap Primers.	X		
17.	Valves	X		

D. Submit Shop Drawings of the Following:

1. Roof drain installation.
2. Trench Drains.
3. Neutralization Basin.

E. Include manufacturer's instructions for each product with submittal.

F. Submit reports and other documents as required.

G. Manufacturer's Certification: Submit manufacturer's certifications as described in Section: GENERAL REQUIREMENTS, PLUMBING.

PART 2. - PRODUCTS

2.01 LEAD-FREE PRODUCTS FOR DOMESTIC (POTABLE) WATER SYSTEM

A. Provide materials, products, and fabrications that comply with Environmental Protection Agency (EPA) requirements and recommendations regarding lead content and contribution of lead to potable water, that have no lead or lead alloys in contact with potable water, and that do not contribute to or cause lead in potable water.

2.02 RELATED PRODUCTS SPECIFIED ELSEWHERE

A. See the following Sections for related products:

1. Foundations, Hangers and Supports: Section: FOUNDATIONS, HANGERS AND SUPPORTS.
2. Insulation: Section: PLUMBING INSULATION.
3. Sleeves: Section: BASIC MATERIALS AND METHODS, PLUMBING.
4. Access Doors: Section: BASIC MATERIALS AND METHODS, PLUMBING.

2.03 FOUNDATIONS, HANGERS AND SUPPORTS

A. General Purpose: Manufacturers Standardization Society SP-69 or Federal Specification WW-H-171d, types as recommended or required. Perforated or plain metal strap and wire are not acceptable.

B. Hangers in Contact With Copper Pipe: Same as for general purpose, copper or copper plated with plastic coating.

2.04 SLEEVES

A. Interior Walls and Floors: PVC pipe, Schedule 40, flush with walls, 3/4" above floors, 1/4" clearance packed with foamed urethane rods.

B. Exterior Walls and Floors, Below Grade: PVC pipe, Schedule 40, flush walls, 1" above floors, 3" clearance packed with foamed urethane rods, sealed watertight at both surfaces with permanent elastic polysulfide or silicon compound, electrically isolated from pipe passing through. **Use of sealants containing Phosphate Esters is specifically prohibited.**

2.05 CLEANOUTS

A. **WCO** (Wall cleanouts): Round stainless steel Wall Access Cover with Screw, 2" larger than O.D. of cleanout plug.

1. **Zurn ZS-Z1469-5**, 5” diameter
2. **Zurn ZS-Z1469-7**, 7” diameter
3. **Zurn ZS-Z1469-9**, 9” diameter
4. **Zurn ZS-Z1469-11**, 11” diameter
5. Equal by **Smith and Josam**

B. **FCO** (Floor cleanouts): Round coated cast iron Access Frame with anchor flanges and heavy-duty scoriated secured cover.

1. **Zurn Z1474**
2. Equal by **Smith and Josam**

C. **YCO** (Yard cleanouts): Cast iron clean-out, double flanged housing, scoriated cast iron cover with lifting device, gasket sealed bronze plug, vandal proof screws, set in 18" square by 5-2" thick cast-in-place concrete block, set flush with finished grade.

1. **Zurn Z1474-VP with Z1440**
2. Equal by **Smith and Josam**

2.06 HOSE CONNECTIONS

A. **WH1** (Wall non-freeze, lockable): Non-freeze, vacuum breaker, 3/4" hose bib, 3/4" supply connection, hinged locking cover, bronze box and cover; **Zurn Z1300,** equal by **J.R. Smith, Josam, Acorn.**

B. **HB** (wall, interior locations): Vacuum breaker, 3/4" hose bib, 3/4" supply connection, with AVB; Jay R. Smith 5672, equal by Zurn, Josam

2.07 VALVES

A. BALL VALVES:

1. Water, Copper Piping Systems: Full port, 3-piece, solder ends, RPTFE seats and gaskets; PTFE impregnated packing; bronze body & end cap. 316 stainless steel ball ball, stem, and body; **Nibco S-595-Y**. Equal by **Hammond or Apollo.**

B. SOLENOID VALVES:

1. Water: Brass body, with Teflon seal & disc, copper shading coil. Size as indicated on plans, standard voltage range of 24,120,240- volts AC, or 6,12,24,120,240- volts DC. **ASCO Red Hat,** 2-Way Solenoid Valve, 8210G, or equal by **Danfoss**, or **Nibco** **Refer to Plans for Additional Information, coordinate all electrical characteristics with electrical contractor.**
2. Gas: Brass body, with Teflon seal & disc, copper shading coil. Size as indicated on plans, standard voltage range of 24,120,240- volts AC, or 6,12,24,120,240- volts DC. **ASCO Red Hat,** 2-Way Solenoid Valve, 8210, certified by the AGA and UL for use with natural gas. Equal by **Danfoss**, or **Nibco** **Refer to Plans for Additional Information, coordinate all electrical characteristics with electrical contractor.**

C. BUTTERFLY VALVES:

1. 2-1/2" and Larger:
   a. Aluminum-bronze disc.
   b. 416 stainless steel shafts.
   c. Resilient seats suitable for 225 degrees F continuous duty.
   d. Cast iron or ductile iron body.
   e. Threaded full-lug wafer body suitable for mounting between ANSI B16.5 150 lb rated flanges.
   f. Extended valve stems of sufficient height to permit insulation of valve body and piping flanges below valve actuator mounting pad.
   g. Bushings between shafts and body of material suitable to provide a bearing surface to eliminate seizing or galling.
   h. Two sintered bronze or stainless steel bushings (one at top and one at lower portions) at top shaft-body area and one sintered bronze or stainless steel bushing at bottom shaft-body area.
   i. Minimum water working pressure rating of 175 psi at 200 degrees F.
   j. Bubble-tight shutoff with 150 lb pressure drop imposed across valve on dead-end service with downstream flange removed.
   k. Valve Operator, 2-1/2" through 4":
      (1) Infinite position lever locking handle.
      (2) Minimum ten position lever locking handle.
   l. Valve Operator, 5" and larger:
      (1) Heavy-duty encased weatherproof gear operators.
      (2) Handwheel.
      (3) Memory stop.
      (4) Ferrous gears, packed box lubrication.
   m. Model: **Nibco LD-2000;** Equal by **Hammond or Apollo**.

2.08 WATER HAMMER ARRESTERS - (SHOCK ABSORBERS)

A. General: Provide a means to prevent water hammer at each branch supply pipe to each fixture of one of the following types.

1. Commercial type, tested and certified in accordance with PDI Standard PDI-WH-201, installed on hot and cold supplies in accordance with PDI Standards, in a manner to prevent water hammer at each fixture.

2. Air Chambers: Of the same diameter as the fixture supply pipe, extending 12" above the fixture runout, air-filled, above each fixture valve. Install in hot and cold water lines at each fixture, or as indicated on Drawings.
3. Provide access door for commercial type if not otherwise accessible.

2.09 ESCUTCHEONS

A. Chromium plated brass at all pipe passing exposed through wall, floor or ceiling in finished rooms; unplated elsewhere.

2.10 CATHODIC PROTECTION

A. Dielectric Fittings:

1. Provide full face flange insulating sets or nylon insulating bushings.
2. Install in a manner to separate dissimilar metals in pressure-carrying water systems, pipe-to-pipe, pipe-to-equipment, pipe-to-valve, etc., and to separate underground protected piping from other underground or above ground structures. Install wherever dissimilar metals join; **Tejas Plastics type "B"**.
3. Dielectric fittings are not required for gravity-flow systems.

B. Sacrificial Anodes: Magnesium or zinc packaged anodes electrically connected to the protected item with packaged fusion weld. Location, weight, and material as indicated in drawings.

2.11 BACK FLOW PREVENTER (BFP)

A. **BFP2** (All Other Areas) High Hazard, Individual Equipment (Laboratory, Processing Equipment, and other areas, size as shown on plans): Continuous pressure type with intermediate atmospheric vent, minimum emergency backflow temperature rating of 250 degree F, minimum pressure rating of 175 psig, tested and certified under ASSE Standard No. 1012, brass body and stainless steel working parts, integral or added strainer, suitable for horizontal or vertical installation as indicated on the Drawings; **Wilkins 375**. Equal by **Watts or Apollo**

B. **BFP3** (Food Service Areas) High Hazard, Individual Equipment (kitchen equipment, size as shown on plans): Continuous pressure type with intermediate atmospheric vent, minimum emergency backflow temperature rating of 250 degree F, minimum pressure rating of 175 psig, tested and certified under ASSE Standard No. 1012, brass body and stainless steel working parts, integral or added strainer, suitable for horizontal or vertical installation as indicated on the Drawings; **Wilkins 375**. Equal by **Watts or Apollo**

C. **Ensure that all BFP's at each campus are properly labeled with Model and Serial Number information. Information plate shall be approximately 3' x 5" and secured to assembly.**

D. Provide (two) sets of wear parts for each backflow preventers installed in the project. The repair parts shall consist of o-rings, gaskets, diaphragms, rubber faced shut off discs, etc.

2.12 WATER PRESSURE REDUCING VALVE

A. **PRV1** Pressure Reducing Automatic Control Valve: ASSE No. 1015, AWWA C506, FDA and NSF Approved, **Wilkins ZW109.** Equal by **Watts or Apollo**

2.13 INDIRECT DRAIN FITTINGS

A. Provide with deep-seal P-trap; size indicated on the Drawings.

1. **AG1 -** Air Gap: 1" to 4" inlet, 2" to 6" outlet, cast iron, threaded or set-screw inlet, spigot or no-hub outlet, air gap greater of 2 times the inlet diameter or 1"; **Wilkins, J.R. Smith, Josam**.
2. **AG2 -** Air Gap: 3" to 1" inlet, :" to 1-2" outlet, cast iron, air gap minimum of 2 times the inlet diameter or 1", whichever is greater; **Wilkins, J.R. Smith, Josam**.

B. **H&T** Hub and Trap: Cast iron, no-hub or spigot outlet, hub inlet sized the larger of the size indicated on the Drawings or 2" larger than the indirect drain indicated, deep-seal P-trap.

C. Provide access door if not otherwise accessible.

2.14 TRAP GUARD

A. All floor drain liquid trap seals shall be protected by a one way natural drain that permits the release of waste water through the drain but closes tightly when the water stops. The seal must be made with a soft elastomeric material made in accordance with the CSA Standard B-602 with a special curl at its bottom. The trap seal device must open up enough to discharge a maximum of 33 GPM of waste water and hold back a minimum of 10.4 PSF sewer gas pressure. Equal to **ProSet Systems TRAP GUARD.**

2.15 FLOOR DRAINS

A. Provide with two-piece body, flashing collars with seepage openings, auxiliary inlet tap for trap primer when indicated, deep-seal P-trap; size indicated on the Drawings.

1. **POLISHED DRAINS**
   a. **FD -** Floor Drain: 8" round type "A" adjustable strainer top, buff-polished nickel-bronze alloy top, vandal-proof and secured; **Zurn ZN415-8B-P-VP**. **Equal by J.R. Smith or Josam.**
   b. **FD1 -** Floor Drain: 7" round type "E2" adjustable strainer top with 4” funnel, buff-polished nickel-bronze alloy top, vandal-proof and secured; **Zurn ZN415-7E-P-VP**. **Equal by J.R. Smith or Josam.**
2. **ROUGH FINISHED DRAINS**
   a. **FD2 -** Floor Drain: 9" square secured top, 5" deep removable sediment bucket; **Zurn Z1901-KC-P-3-32. Equal by J.R. Smith or Josam**
3. **FLOOR SINKS**
   a. **FS1 -** Floor Sink: 11.5" square top, 6" deep body, flange with weep holes and clamp ring, acid-resisting porcelain enameled interior, non-tilt loose acid-resisting porcelain enameled quarter-open grate, aluminum internal dome strainer; **Smith 3420-13, Josam 49340-4**. **Equal by Zurn.**

B. Backwater Valves: Ball float adapter for floor drain, cast iron galvanized body, elastomer seat, plastic ball, bronze ball cage; **Zurn Z1099-G. Equal by Watts or Apollo**

2.16 ROOF DRAINS AND ACCESSORIES

A. Provide with flashing and membrane clamp, stainless steel bolts, sump receivers, under-deck clamps, and extensions for roof drains as required by the installation; size indicated on the Drawings.

1. **RD -** Roof Drain: Large cast iron body, Leveleze adjustable collar, deck clamp, drain receiver, bottom or side outlet; size as indicated on drawings; **Zurn ZC100-DP, J.R. Smith 1015, Josam 21000-1-2-23 or 21010-1-2-23**.
   a. Cast Iron dome.
2. **OD -** Overflow Drain: Same as Roof Drain RD1, except, add 2" high integral, combination, water-dam and gravel-guard.
   a. Cast Iron dome.
3. **SP** - Downspout Nozzle: **Zurn ZAB199, J.R. Smith, Josam 25010 series.**

2.17 BUILDING SEWER (5' Outside Building and Beyond)

A. Plastic: Polyvinyl chloride (CPVC) sewer pipe and fittings, ASTM D2846; solvent cement ASTM F493. Where cover to finish grade is greater than 6', encase in 4" thick concrete, reinforce with four evenly spaced #3 rebar.

2.18 WASTE, DRAIN AND VENT (Within building to 5' outside)

A. Below Slab or Above Slab – All other areas use one of the following.

1. Schedule 40 polyvinyl chloride (PVC) pipe and fittings, ASTM D2665; solvent cement ASTM D2564.

2.19 VENT (2-1/2" and smaller)

A. Below Slab or Above Slab: Use one of the following:

1. Schedule 40 polyvinyl chloride (PVC) pipe and fittings, ASTM D2665; solvent cement ASTM D2564.

2.20 DRAIN (Indirect)

A. Copper: Drainage tube (DWV) pipe ASTM B306; fittings, cast bronze solder-joint, ANSI B16.23 or wrought copper and wrought copper alloy solder-joint, ANSI B16.29; solder, ASTM-70, 50A.

2.21 DOMESTIC WATER (Interior to 5' outside)

A. CPVC: Charlotte Pipe FlowGuard (CTS) Pipe and Fittings System, ASTM D 2846;

1. Fittings: FlowGuard Gold
   a. CPVC FlowGuard Gold fittings by Charlotte Pipe for all domestic water piping fittings 1/2” to 4” in size.
   b. Attic stock
      (1) 6 (six) of each fittings used on the project. Size’s 1/2” to 1-1/2”
      (2) 2 (two) of each fittings used on the project. Size’s 2” and larger.
   c. Provide standard manufacturers on-site training and quality control inspections.

B. In kitchen and servery area, all domestic water in-wall, and through wall piping shall be Copper, Straight water tube, K or L, ASTM B88 or B543;

C. Where Indicated on Drawings to be Below, in, or Through Slab-On-Grade: Copper, coiled water tube, K or L, ASTM B88; wrought copper and bronze solder-joint pressure fittings, ANSI B16.22; solder, lead free, ASTM B32. Pipe in or under slabs-on-fill shall be continuous, without joints or fittings.

2.22 STORM-WATER DRAINAGE (DS, RD, SD) (Within building to 5' outside)

A. Cast-Iron, Below Slab: Service hub-and-spigot ASTM A74; rubber gaskets, ASTM C564.

B. Cast-Iron, Above Slab: No hub, Cast Iron Soil Pipe Institute Standard 301, ANSI Group 022, for pipe, fittings, and gaskets.

C. Above or below slab: Schedule 80 CPVC pipe and fittings, ASTM D2846; solvent cement ASTM F493.

2.23 STORM-WATER DRAINAGE (DS, RD, SD) (Underslab and 5' Outside Building and Beyond):

A. Plastic: CPVC sewer pipe and fittings, ASTM D2846. Where cover to finished grade is greater than 6', encase in 4" thick concrete, reinforced with four evenly spaced #3 rebars.

2.24 DOMESTIC CLOTHES WASHER CONNECTION

A. **Acorn** Hose Supply Box **8186** Stainless Steel, recessed hose supply box with wall flange. **Equal by Guy Gary or Plastic Oddities**

2.25 ICE MAKER VALVE BOX

A. **Oatey Metal Ice Maker box**, box of 20ga. Steel, faceplate of 28ga. Steel. **Equal by Guy Gary or Plastic Oddities**

2.26 CIRCULATING PUMPS

A. Refer to Pump Schedule on Plans.

2.27 THERMOSTATIC MIXING VALVE

A. **Refer to Plans for Mixing Valve Locations**

1. **Thermostatic Mixing Valve TMV**, Thermostatic Mixing Valve Assembly (TMVA) shall be of DZR brass construction with stainless steel internal operating mechanism. All required installation components shall be supplied pre-plumbed and pressure tested. TMVA shall be supplied pre-piped with hot inlet, cold inlet, mixed water outlet and mixed return inlet with thermostatic return limiter to maintain circuit temperature during no-demand periods. TMVA shall also include as standard, mixed return sight flow indicator, outlet thermometer and inlet supply, mixed return and return to heat source check valves. TMV shall be equipped with removable temperature adjustment key with lockshield for single temperature lock out capability. TMVA shall have dual thermostats for increased accuracy and to provide redundancy in case of individual thermostat failure. Model, **Rada 40R, or equal by Lawler, Leonard.**
   a. Materials of construction and items included shall be:
      (1) DZR brass/stainless steel
      (2) 1-1/2” NPT inlets and outlets
      (3) Integral inlet check valves
      (4) Integral slight flow indicator
      (5) Integral thermometer
      (6) Thermostatic return limiter
      (7) Dual Thermostats
   b. Performance: TMVA shall be capable of passing 72 gpm in a recirculating hot water system at peak demand at a 20 psi pressure drop. TMVA shall be capable of maintaining system temperature without exceeding set point with no required

minimum flow rate through the TMVA or minimum draw-off from the system. TMVA shall be compliant with ASSE Standard 1017 and CSA B125 and shall be so certified and identified.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions and with the Drawings. Fasten each item of equipment and piping securely to the building structure.

B. Do not fasten piping or conduit to any removable panel on equipment.

C. Provide unit vibration isolators. Adjust unit vibration isolators to provide proper condensate flow to drain connection.

D. Install equipment and associated piping and other connections in a manner to prevent conduction of sound to the framing and structural elements of the building.

E. Provide necessary material and labor to connect to the plumbing systems all indicated fixtures and equipment having plumbing connections.

F. Provide necessary material and labor to connect to the plumbing systems all indicated fixtures and equipment having plumbing connections and which are to be furnished by the Owner or are specified in other sections of these documents.

G. Provide all fittings and appurtenances for complete, operating piping systems.

H. Complete the start-up procedures recommended by the manufacturer.

3.02 EXCAVATION, TRENCHING AND BACKFILLING (All Buried piping)

A. Beneath Slabs: Excavate carefully; do not destroy effect of capillary barrier, membrane, or special fills.

B. All areas refer to information provided by Testing Lab to Architect for requirements.

3.03 ROUTING OF PIPING SYSTEMS

A. Where to Conceal: Conceal in pipe chases, walls, furred spaces, or above the ceilings of the building unless otherwise indicated.

B. Where to Expose: In mechanical rooms, only where necessary, piping may be run exposed. Where exposed, run in the neatest, most inconspicuous manner, parallel or perpendicular to the building lines.

C. Support: Support adequately and properly from the building structure by means of hanger rods or clamps to walls.

D. Maintaining Clearance: Where limited space is available above the ceilings and below beams or other deep projections, sleeve through the projection where it crosses rather than hang below them, in a manner to provide maximum above-ceiling clearance.

3.04 WASTE, DRAIN, VENT, AND SEWER PIPING

A. Slope: 1/4" per foot where possible; 1/8" per foot minimum; other as indicated on drawings.

B. In Trench:
   1. Excavate at point of origin and point of connection to existing system and at in-trench high point of the new system.
   2. Determine actual elevations of both.
   3. Obtain services of registered public surveyor to set batter boards.
   4. Set batter boards on maximum 20' spacing to establish grade of trench bottom for the actual elevations encountered.
   5. If the slope indicated on the Drawings cannot be obtained, notify the Architect-Engineer before proceeding with the remainder of the excavation.

C. Acid Waste and Vent Piping

   1. Install piping and fittings according to manufacturer's recommendations.
   2. Install piping material according to the following schedule:
      a. Below the Lower Suspended Slab: PP with fusion joints.
      b. Below Ground: PP with fusion joints.
      c. In Fire-rated Chases or Enclosures: PP with fusion joints.
      d. In Laboratory Cabinets: PP with mechanical joints.
      e. Other Locations: SI or GP with mechanical joints.

3.05 ROOF AND DECK PENETRATIONS

A. Vent pipes projecting through the roof or waterproof deck: Flash with four-pound-per-square-foot sheet lead extending 10" away in all directions, turned into the top of the pipe a distance of at least 1". Extend vent pipes 12" above top of roof.

B. Other pipes passing through roof or waterproof deck: Seal by a pitch-pocket, flashed into the waterproofing, filled with roofing pitch, and capped around pipes. Extend pitch pockets 12" above top of roof.

3.06 FLOOR, ROOF, DECK, AND OTHER DRAINS

A. Follow drain and membrane system manufacturer's requirements and recommendations for installation of drains in waterproofing membranes.

3.07 LEAK TESTING

A. Water Piping: 100 psi hydrostatic pressure; four hours.

B. Waste, Drain, and Vent Piping: Plug all openings and fill with water to the topmost vent opening; 24 hours.

C. Gas Piping:

   1. Subject Gas piping to a pneumatic pressure test of 60 psi for 30 minutes.
   2. While under pressure test, apply soapy water solution to all welded joints for the purpose of detecting leaks.
   3. If leaks are found in welded lines, repair by chipping rewelding operations
   4. Repeat, alternating testing and welding operations until the gas piping systems are absolutely tight.
   5. If leaks are found in threaded joints, repair by properly tightening or replacing fitting.
   6. Repeat, alternating testing and repair operations until the gas piping systems are absolutely tight.

7. Final test entire gas piping system to a pneumatic pressure of 50 psi for a period of 24 hours and demonstrate that the piping system is absolutely tight.
8. Perform any additional tests as required by code, City or governing body.
9. Comply with Georgia HB 1611.
10. Complete gas certification forms and submit copies to owner, architect, & utility company. Railroad Commission of Georgia form PS-86 & PS-87.

D. Roof Drains:

1. Insert a balloon plug into the drain outlet from above the roof to just below the drain-to-pipe joint.
2. Fill the drain and surrounding roof area with water.
3. Do not fill roof area more than 2" above the flow line of the gravel stop; do not plug more that one roof drain and its companion overflow drain at one time; do not load roof beyond its structural holding capacity.

E. Smoke Pressurization Testing of Waste System

1. Coordinate with the District’s third party testing firm.

F. Camera TV Video Recording of all main Storm Drain and Sanitary Sewers in and under the Building.

1. Coordinate with the District’s third party testing firm.

3.08 WATER SYSTEM STERILIZATION

A. Initial Sterilization:

1. After completion of all work on the water lines, thoroughly sterilize as prescribed by AWWA Standard C601 or as specified herein.
2. After pressure tests have been made and before introducing the chlorinating material, thoroughly flush the lines to be sterilized with water until all entrained dirt, oil, mud, and other pollutants are removed.
3. Place the chlorinating material directly into the lines to be sterilized in an amount to provide a dosage of not less than 50 parts per million (ppm).
4. Retain the treated water in the line for the longer of: time required to destroy all non-spore-forming bacteria, or for 24 hours.
5. Open and shut all valves on the system being tested several times during the contact period.
6. After acceptable sterilization, flush the system with potable water until the residual chlorine is reduced to less than 0.1 ppm.

B. Maintained Sterile Condition.

1. Take several samples of water from several points in the system daily and test for bacterial contamination.
2. Repeat sterilization and sampling until tests indicate absence of bacteria for at least two full days.

3.09 LEAD TESTING

A. After final sterilization and flushing, test water at each lavatory, drinking fountain, sink, and other fixtures and fittings from which water for human consumption may be obtained for lead content. Submit report of test results in parts per billion (ppb).

B. If lead content exceeds 20 ppb, flush system or implement other remedies or submit test results that indicate the ppb to be no higher than that of the water where the project water service joins to the existing water source.

3.10 JOINING TO EXISTING SYSTEMS AND DISSIMILAR MATERIALS

A. General: Provide appropriate adapters recommended by the manufacturers of the various materials; install as recommended by the manufacturers of the various materials.

B. Connections to Existing Piping: Where new Work connects to existing systems, match the material of the existing system except as prohibited by the Local Authority or job conditions cause the material to be in non-compliance with manufacturer's requirements.

C. Point of Connection:

1. Determine horizontal and vertical location of connecting point before proceeding with the installation.
2. Notify the Architect-Engineer before proceeding if there is discrepancy between indicated and determined location.

D. Slope of Drainage Systems:

1. Determine available slope between building systems and point of connection for discharge of building drain and of storm drain system.
2. Notify the Architect-Engineer before proceeding if there is discrepancy between indicated and available slope.

3.11 START-UP AND TESTING

A. Put systems into operation.

B. Test equipment performance.

C. Adjust equipment for correct capacities.

END OF SECTION 221000

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 224000 - PLUMBING FIXTURES

PART 1. - GENERAL

1.01 DOCUMENTS

A. Related documents are as follows:

1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. General Requirements, Plumbing.
3. Basic Materials and Methods, Plumbing.
4. Other sections of the specifications as applicable.

1.02 QUALITY ASSURANCE

A. Standards: Comply with the minimum standards prescribed in requirements and recommendations of the latest edition of the following codes and standards:

1. Underwriter's Laboratories, Inc. Standards.
2. National Association of Plumbing-Heating-Cooling Contractors, and American Society of Plumbing Engineers (NAPHCC/ASPE) Standard: National Standard Plumbing Code.
3. UPC, "Uniform Plumbing Code"
4. International Plumbing Code.
5. NFPA 54, "Gas Appliances and Gas Piping."
6. Other codes, ordinances, and laws applicable to the place of the Work.

B. Acceptable China Manufacturers:

1. Zurn
2. Crane
3. American Standard

C. Acceptable Fitting Manufacturers:

1. Zurn
2. Chicago
3. Speakman
4. American Standard
5. T&S Brass

D. Acceptable Stainless Steel Fixture Manufacturers:

1. Just
2. Elkay
3. Advance Tabco

E. Acceptable Flush Valve Manufacturers:

1. Zurn AV
2. Sloan Royal – Not Regal or Sloan Valve
3. Delaney
4. American Standard

F. Acceptable Water Cooler Manufacturers:

1. Haws
2. Elkay
3. Halsey-Taylor

G. Acceptable Water Heater Manufacturers (electric & gas fired)

1. Lochinvar
2. A.O. Smith

1.03 SUBMITTAL

A. Product Data for all items incorporated into the Work. **Sections 224000 and 224400 to be fully incorporated into one complete submittal. Submittal to be neatly organized based on section and clearly labeled with each product designation. Format for submittal is to be electronically with clear indication on the cover including job name, GC, sub-contractor, and submitted sections.**

B. Submit Shop Drawings of the Following:

1. Field or shop fabricated carriers.

PART 2. - PRODUCTS

2.01 FIXTURES

A. General:

1. Provide fixtures, brass, trim, stops, supplies, wastes, traps, carriers and supports, and other accessories in a manner to provide a complete installation.
2. Coordinate the elements of each fixture such that the proper model of the style indicated is provided, properly selecting drillings, carriers and supports, and other accessories.
3. Provide completely installed fixture assemblies that comply with manufacturer's requirements and recommendations. Notify the Architect-Engineer of conflicts between this and other requirements of the Contract Documents.

B. Fixtures: New, of current manufacture and of the best of their respective kinds, free of blemishes, waves, kiln marks and discoloration; all fixture surfaces in contact with walls, floors, and other building surfaces, truly flat.

C. Exposed metal associated with fixtures including pipe, traps, nuts, bolts, washers, etc: Stainless steel or chromium plated brass.

D. Nuts exposed to direct view: Capnuts (closed top) type leaving no screw threads exposed.

E. Supports: Provide steel back-up located inside chase or wall for wall hung fixtures not specified to be furnished with carriers. Weld bolts to the angle and extend through wall to fixture hangers. In addition to the upper hanger, drill bolt holes through lower skirt of wall hung lavatories, electric water coolers, and other similar fixtures and secure by bolts through skirt into steel back-up.

F. Provide with manufacturers complete five year warranty for those fixtures specified as Zurn One.

2.02 FIXTURE SCHEDULE - **REFER TO ARCHITECTURAL DRAWINGS FOR ALL MOUNTING HEIGHTS AND ADA COMPLIANCE**

A. P1 NOT USED

B. **P1A Water Closet** (Adult Barrier-free Height, floor mounted, flush valve 1.6 gpf)

1. Fixture: Vitreous China, siphon jet, elongated rim, flush valve, top spud, water-saver; **Zurn Z5665-BWL**
2. Seat: White, elongated, open front, no cover, solid non-staining fire-resistant thermosetting plastic, stainless steel self-sustaining check hinge; **Sperzel 150EWCH, Olsonite No. 95, Beneke 523, Centoco No. 500CC., Zurn Z5955LC-SS-EL**
3. Flush Valve: Quiet closet flush valve, brass, 1" ips screwdriver back-check stop with protective cap, adjustable 24" tailpiece, vacuum breaker elbow flush connection and spud coupling for 1-1/2" top spud, non-hold-open handle, exposed parts chromium plated; **Zurn Z6000AV-WS1.** (LOCATE FLUSH HANDLE ON WIDE SIDE OF STALL.)
4. Fittings: Closet bolt / wax ring kit; **Zurn Z5972-COMB**
5. Provide manufacturer's standard (5) year warranty on all parts and labor.

C. **P4A Lavatory (Counter mount Hot/Tempered and Cold, Barrier Free)**

1. Fixture: Integral with counter, reference Architectural plans
2. Fitting: Single post metering faucet, deck mounted **Zurn Z86300-CP4 (confirm deck mounting type with counter)**
3. Trim: Chromium plated quarter-turn brass angle supply with 1/2" OD x 12" flexible riser, 3/8" ips x 1/2" OD loose key stop, wrot escutcheon; chromium plate all metal parts; **(Zurn #Z-8801-LR-LK-PC) (Z-8743-PC Grid Drain) (Z-8746-1-NT Trap Wrap)**
4. Waste: 1-1/4" x 1-1/4", 17 gauge bent tube p-trap, cast brass nuts, threaded brass cleanout plug, wrot escutcheon; chromium plate all metal parts; **(Zurn # Z-8700-8B-PC)**
5. Insulation Kit: Provide wheelchair insulation kit for all waste, water and associated appurtenances exposed under lavatory. **Zurn Z-8946-1-NT.**
6. Water Temperature Guard: **Zurn 3870.**
7. Provide manufacturer's standard (5) year warranty on all parts.

D. **P6 Sink (**Barrier Free, 4" deep, Cold & Hot/Tempered Water, Single compartment, countertop, stainless steel)

1. Fixture: 18 gauge type 305, 18-8 stainless steel, single compartment, undercoated sink, 22"x19"; **Just SLADA1921AGR**
2. Fitting: Chrome plated swing spout, deck mount, ½" ips inlets, **Zurn Z-871G1** with 2-3/4" Lever Handles.
3. Trim: Chromium plated brass angle supply with 2" od x 12" flexible riser, 3/8" ips x 2" od loose key stop, wrot escutcheon; chromium plate all metal parts; **Zurn Z-8801-LR-LK-PC.**
4. Sink Strainer: Chromium plated forged brass or stainless-steel basket strainer with 1-1/2" x 4" 17 gauge tailpiece; **Zurn Z-8741-SS.**
5. Waste: 1-2" x 1-2" 17 gauge bent tube p-trap, cast brass nuts, threaded brass cleanout plug, wrot escutcheon; chromium plate all metal parts; **(Zurn # Z-8702-9-PC)(Z-8751-SC Continuous Waste).**
6. Water Temperature Guard: **Zurn ZW3870T-4P**
7. Insulation Kit: Provide wheelchair insulation kit for all waste, water and associated appurtenances exposed under lavatory. **Zurn-8946-1-NT Trap wrap**
8. Provide manufacturer's (5) year warranty on all parts and labor.

A. **P7 Electric Water Cooler (Wall-mounted, Standard Height)**

1. Fixture: Self-contained, wall mounted, electric water cooler, Type 304 stainless steel type 302 fountain top with anti-splash basin design, brass chrome plated mound building bubbler, flow regulator, air cooled condensing unit, hermetically sealed compressor, 1/5 hp 115v motor, capacity to cool 8.0 gph from 80° F to 50° F with 90° F ambient; **Halsey Taylor HVR8-S.**
2. Trim: Chromium plated quarter-turn brass angle supply with 3/8" ips x 1/2" od fixed key stop, wrot escutcheon; chromium plate all metal parts; **McGuire BV-02.**

B. **P7A Electric Water Cooler (Wall-mounted, Barrier Free, Bottle Filling Station)**

1. Fixture: Self-contained, wall mounted, electric water cooler, Type 304 stainless steel type 302 fountain top with anti-splash basin design, brass chrome plated mound building bubbler, flow regulator, air cooled condensing unit, hermetically sealed compressor, 1/5 hp 115v motor, capacity to cool 8.0 gph from 80° F to 50° F with 90° F ambient; **Halsey Taylor HTHBHVR8-NF**
2. Trim: Chromium plated quarter-turn brass angle supply with 3/8" ips x 1/2" od fixed key stop, wrot escutcheon; chromium plate all metal parts; **McGuire BV-02.**
3. Waste: 1-1/4" x 1-1/4" 17 gauge bent tube p-trap, cast brass nuts, threaded brass cleanout plug, wrot escutcheon; chromium plate all metal parts; **McGuire 8872C.**

C. **P8 Service Sink**

1. Fixture: Terrazo Mop Service Basin, 24"x24"x10", color as selected by Architect, 3" integral drain; **Stern Williams SB850 or equal by Fiat**.
2. Trim: Service sink faucet with 3/4" vacuum breaker, hose thread, pail hook, wall brace, integral stops; **Zurn Z843M1.**
3. Accessories:
   a. Mop Hanger – 24" **Stern Williams T40.**
   b. Hose and Hose Bracket – **Stern Williams T35.**
4. Water Temperature Guard: **Lawler TMM-1070**

D. **P9 Water Heater** (Electric)

1. Fixture: 120-gallon, 2-18 KW elements simultaneous operation, 208 volt, 3-phase, (verify voltage with Electrical Contractor) anode, glass lined tank rated @ 125 psi working pressure, constructed to ASME and UL standards, 10 year warranty; **Lochinvar CHV-480-36-150**. (Plumbing contractor to coordinate all electrical requirements with Electrical contractor)
2. Trim: ASME temperature and pressure relief valve, shut-off valve, integral NEC disconnect switch.
3. Expansion Tank: **Wilkins WTTA-8**

E. **P9B Water Heater** (Electric)

1. Fixture: 40-gallon, 1-4.5 KW elements, 208 volt, 3-phase, (verify voltage with Electrical Contractor) anode, glass lined tank rated @ 125 psi working pressure, constructed to ASME and UL standards, 10 year warranty; **Lochinvar ETX40-P4500**. (Plumbing contractor to coordinate all electrical requirements with Electrical contractor)
2. Trim: ASME temperature and pressure relief valve, shut-off valve, integral NEC disconnect switch.
3. Expansion Tank: **Wilkins WTTA-8**

PART 3. - EXECUTION

3.01 GENERAL

A. Provide competent foreman or supervisor for the installation of the equipment and to counsel other trades in regard to connections and installation. Install fixtures, carriers, fittings, trim, relief valves, and other appurtenances in accordance with Manufacturer's recommendations. Install equipment level and square in proper planes with other work, secure anchorage in place. Test operation of project, provide full instructions and demonstrate to the Owner's designated representative the proper methods of care, operations, and maintenance of the equipment.

B. **Install wall hung fixtures on carriers or supports specified above. Provide locking nut tightened against fixture mounting nut on both sides of the fixture (double nut).**

C. Grout plumbing fixtures at walls and floors with fine tile grout.

D. Protect fixtures and equipment during construction. Cover fixtures as required for proper protection during construction. Clean fixtures for substantial completion.

E. Anchor supply piping with "U" bolts and a steel angle at wall penetrations to prevent pipe movement.

F. Install water heaters in accordance with Manufacturer's recommendations. Install the relief valves so that the bulbs will be immersed in the tanks. Pipe relief valve outlet full size to the exterior of the building and terminate per Code.

G. Secure skirts of wall hung fixtures to the wall with toggle bolts. Secure floor outlet fixtures in place by bolting rigidly to the floor.

H. Install gas boiler direct vent kit with schedule 40 PVC pipe in accordance with equipment manufacturer’s installation guide.

I. Install gas water heater direct vent kit with schedule 40 PVC pipe in accordance with equipment manufacturer’s installation guide.

J. Provide boiler manufacturer start-up and certification of equipment prior to acceptance by owner.

K. Provide water heater manufacturer start-up and certification of equipment prior to acceptance by owner.

L. At the end of the project as part of close-out, contractor to adjust and document water temperatures at fixtures as follows:

1. Boiler supply temperature set at 140 degrees Fahrenheit.
2. Set thermostatic mixing valve for a maximum temperature of 110 deg F. This should set the maximum temperature for showers at 110 deg F.
3. Adjusting the point of use blending valves at the lavatories for delivering a maximum temperature of 105 deg F.
4. Kitchen faucets at scullery sink, pot sinks, and dishwash spray should be set at 140 F (non-tempered). Kitchen hand wash sinks, adjust the point of use blending valves for delivering a maximum temperature of 105 deg F.

END OF SECTION 224000

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 230500 - GENERAL REQUIREMENTS, HVAC

PART 1. - GENERAL

1.01 WORK INCLUDED

A. This section is applicable to and a part of all Division 23 sections of the Project Manual.

1.02 QUALITY ASSURANCE

A. Publications

1. Copies: Obtain copies of trade association standards and publication wherever needed for proper execution of the work.
2. Publication Date: Comply with the issue of applicable standard or publication which is in effect at the date shown on these contract documents. Obtain approval from the Architect-Engineer to comply with a later issue of a standard or publication.
3. Conflicting Requirements: Report to the Architect-Engineer where application of a trade association standard or publication appears to be in conflict with the requirements of the contract documents.

B. Product Standards: Listed in the current edition of UL "Electrical Construction Materials Directory," if such a listing exists for the particular type of item specified.

C. Reference Standards:

1. Meet or exceed the recommendations and requirements of reference standards.
2. Submit proof (stamp, label, published listing or independent certified test).

D. Servicing: Provide products supported by a service organization that is reasonably convenient to the site.

E. Nameplates:

1. Securely attach to each major component of equipment, visible and readable, name, address, and model identification number on a plate.
2. Do not cover with paint, insulation, or other material.

F. Manufacturer's Instructions: Follow the manufacturer's published instructions in preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated by the Contract Documents.

G. Capacities: Meet or exceed capacity requirements indicated. Stay within maximums, minimums and other limits. Prevent components or systems from becoming inoperative or damaged because of start-up, overload, or other conditions.

H. Suitability: Provide products suitable for the pressures, temperatures, fluids, voltages, environmental conditions, and other conditions encountered by the indicated application.

I. Protection from Moving Parts: Provide enclosures and guards for belts, pulleys, chains, gears, couplings, projecting set-screws, keys, hot surfaces and other hazardous parts located where persons can come in close proximity.

J. Spare Parts Data: Provide spare parts data prior to Substantial Completion.

K. Standard Products: Provide standard cataloged products of manufacturers regularly engaged in the manufacture of products that essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years.

L. Connections to Utilities:

1. Provide the services of a person or company approved by the respective utility authority to make connections to:
   a. Water supplies.
   b. Sanitary sewer.
   c. Storm sewer.
   d. Gas.
   e. Electrical power.
   f. Telephone.
   g. Other utilities.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. The Owner shall give notice of observed defects with reasonable promptness.
4. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

C. Submittals:

1. **Mechanical Product Data Submittals to be organized and submitted as ONE complete submittal** as follows (excludes shop drawings):
   a. Cover Sheet listing project name, date, GC, Subcontractor
   b. Index Sheet
   c. The contractor shall include a formal letter to the engineer, included in the submittal after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   d. Organize all required items by numerical specification section with tabbed dividers including section number and title. Each section to provide a subsequent index cover.
   e. Submittals not organized as indicated above may be rejected without review.
2. The contractor may require his subcontractors to provide coordination drawings indicating all trades, such drawings will not be reviewed by the engineer.
3. Unless agreed upon with the engineer, electronic submittals are not acceptable.
   Shop drawings are to fully drawn/designed and coordinated by the contractor. Any replication of original bid documents will be rejected.

D. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract.
   b. Approved fixture/equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   e. Any and all data and/or plans required during construction.
   f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
   g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

E. Training:

1. Upon completion of the work and at a time designated by the Owner’s representative, provide a formal training session for the Owner’s operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner’s representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner’s representative and Engineer as a condition of final acceptance.

F. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

G. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered

separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.

2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle products carefully to prevent internal component damage, breaking or denting.

B. Store products in clean, dry space, protected from dirt, fumes, water, construction debris and physical damage.

C. Do not install damaged equipment or materials.

1.05 PRODUCT APPLICATION, INSTALLATION, AND OPERATION

A. General: For products incorporated into the Work, the Contractor shall ascertain the following:

1. Application:
   a. The manufacturer's representatives have reviewed the proposed application of their products.
   b. The application and product are compatible regarding:
      (1) Operation.
      (2) Electric Source.
      (3) Piping.
      (4) Controls.
      (5) Location.
      (6) Proximity to other products and elements of the work.
      (7) Structural support and integrity.
      (8) Other pertinent factors.

B. Installation: The installers were instructed in the manufacturer's recommended procedure for installation, and the product was installed according to the manufacturer's recommendations.

C. Operation: The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up, the products are operating as intended by the Contract Documents, and the application and product are compatible regarding the same factors named above.

D. Installation: Submit letter following installation of the manufacturer's product stating the following:

1. The installers were instructed in the manufacturer's recommended procedure for installation.
2. The product was installed according to the manufacturer's recommendations.

E. Operation: Submit letter with Owner's final documents stating the following:

1. The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up.
2. The products are operating as intended by the Contract Documents.
3. The application and product are compatible regarding the same factors named above.

F. Signature on Letter: By manufacturer's representative

PART 2. - PRODUCTS

Not Used

PART 3. - EXECUTION

3.01 TESTING

A. All mechanical systems shall be subject to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation regardless of the season. The Contractor shall test all HVAC equipment in both the heating and cooling modes.

B. All new HVAC systems shall be operated separately and coincident with other HVAC Systems for a period of time to demonstrate to the satisfaction of the Owner, Engineer and Architect the ability of the equipment to meet capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications.

C. Prior to any such tests, the Contractor shall have set all valves, dampers, motors, controllers, thermostats, etc., and shall have the system(s) operating and maintaining design temperatures, humidity and air circulation throughout all areas of the building and project.

D. Make adjustments as required to ensure proper functioning of all systems.

E. Additional specific tests on individual systems are specified under individual sections of the specifications.

END OF SECTION 230500

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 230501 - BASIC MATERIALS AND METHODS, HVAC

PART 1. - GENERAL

1.01 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with work similar to that required for this project.

C. NEC Compliance: Comply with the National Electric Code, NFPA 70.

D. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

1.02 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit the following Product Data, Shop Drawings, and Samples.

Item	Prod Data	Shop Dwgs	Samples
Access doors	X		
Motors	X		
Motor disconnects	X		
Motor controllers	X		
Foundations			
Roof and deck penetrations	X	X	
Sleeves	X		
Floor and ceiling plates	X		
Cutting and patching	X		

C. Include manufacturer's instructions for each product with submittal.

D. Submit reports and other documents as required.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle products carefully to prevent internal component damage, breaking or denting.

B. Store products in clean, dry space, protected from dirt, fumes, water, construction debris and physical damage.

C. Do not install damaged equipment or materials.

PART 2. - PRODUCTS

2.01 ACCESS DOORS

A. **AD1** Access Door (Paintable, flanged): If not otherwise accessible, provide a thin-flanged, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, steel construction, primed for field painting as specified in Section: PAINTING; **Smith 4760**.

B. **AD2** Access Door (Stainless steel, flanged): If not otherwise accessible, provide a thin-flanged, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, 18-8 stainless steel construction with No. 4 finish; **Smith 4762**.

C. **AD3** Access Door (Paintable, flush): If not otherwise accessible, provide a flush-with-wall, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, steel construction, primed for field painting as specified in Section: PAINTING; **Smith 4765**.

D. **AD4** Access Door (Stainless steel, flush): If not otherwise accessible, provide a flush-with-wall, framed access door, minimum of 10" square or adequate to service the device, secured by vandal-proof screws, 18-8 stainless steel construction with No. 4 finish; **Smith 4767**.

E. Secure doors with the following:

1. In janitor's closets, mechanical rooms, storage rooms, and other places not accessible to the public; Phillips-head screws, stainless steel or bright chromium plated.
2. Phillips-head screws, stainless steel or bright chromium plated.
3. Other locations: Secure doors with cylinder key lock, all keyed alike. Furnish minimum of one key per door.
4. Other locations: Secure doors with vandal-proof screws.

2.02 MOTORS

A. General: Provide electric motors selected and furnished by the suppliers or manufacturers to accommodate equipment, machines, and other products requiring drivers.

B. Classification: Where classification is specified, comply with NEMA MG 1-1972, "Motors and Generators."

C. Characteristics, Ratings: Where speed, horsepower, electrical characteristics, service factor, frame type is specified, comply with NEMA MG 1-1972, "Motors and Generators."

D. Installation: Install motor on suitable base, connect to the driven item, align and connect couplings, pulleys, and other driven items.

E. Provide energy-efficient motors complying with the following schedule:

HP	**Efficiency%**	**Power Factor**
1	82	84
1-2	83	85
2	84	85
3	85	86
5	87	87
7-2	88	87
10	89	88
15, 20	90	88
25	91	88

PART 3. - EXECUTION

3.01 ACCESS DOOR INSTALLATION

A. Install access doors in places where controls, valves, electrical junction boxes, and other devices and fittings that have serviceable or adjustable elements, or otherwise require access.

B. Type to Install:

1. Painted Walls (concrete block, drywall, plaster, other painted walls): Paintable Flanged (AD1), Paintable Flush (AD3).
2. Other Walls (glazed brick or tile, washable surface, outdoors or otherwise exposed to high humidity): Stainless Steel Flanged (AD2), Stainless Steel Flush (AD4).
3. Provide flanged type unless otherwise indicated to be flush type or if other elements in the same wall are flush type.

3.02 COORDINATION

A. General: Coordinate the configuration, location and arrangement of various products and systems to avoid conflict with other products.

B. Precedence: Give precedence to sloping of pipe for drainage and to electrical bus duct for minimizing offsets

C. Clearances: Maintain clearances at heated surfaces and at electrical raceway.

D. Exposed Work: Keep as close as practical to walls, ceilings, columns, and other elements of the Work so as to take up the minimum amount of space.

E. Common Hangers and Supports (Trapezes): Use wherever practical.

F. Alignment: Align piping and raceways of various systems.

G. Work in Ceilings: Follow reflected ceiling plans (both Contract Documents and Shop Drawings) for layout of Work in ceilings.

H. Thermostats and Electrical Devices on Walls and Floors: Coordinate height above floor and spacing when within close proximity of each other.

3.03 CLEANING AND PAINTING

A. General: Painting is specified in Section: PAINTING.

B. Cleaning: Clean surfaces to be painted of rust, oil, grease, mortar, construction rubble and other foreign substances.

C. Paint accessible ferrous metal (excluding corrosion resistant metal), regardless of whether exposed or concealed behind ceilings, shaft enclosures or similar construction, including uncovered pipes, frames, supports, and other ferrous elements.

1. Remove rust and scale by sand blasting and wire brushing.
2. Clean with solvent and apply a treatment of phosphoric acid.
3. Apply a primer coat of red oxide pigmented alkyd ferrous metal primer, 1.5 mil thickness.
4. Apply two (2) coats of gloss alkyd enamel in accordance with Federal Specification TT-E-489 of a color selected by the Architect-Engineer, 3.0 mil 2-coat thickness.

D. Paint interior and exterior exposed zinc-coated (galvanized) metal surfaces.

1. Clean surface with solvent and treat with vinyl-type wash coat.
2. Apply a first coat of zinc dust-zinc oxide primer (Fed Spec TT-P-641G, Type II), and a second coat of oil base exterior paint, color as selected by Architect-Engineer.

E. Paint only in the following areas:

1. Where indicated on the Drawings or elsewhere.
2. Outdoors.
3. Non-ventilated spaces beneath buildings.
4. Commercial kitchen hoods.
5. Showers.
6. Other high-humidity areas.

F. Factory Finishes: Items factory furnished with a finish coat of paint need not be painted unless a special finish or color is specified.

G. Damaged Finishes: Repair finishes of new and existing materials which have been damaged.

H. Do not paint nameplates on equipment; sliding or rotating shaft surfaces; non-ferrous hardware, accessories, trim; and similar items where painting would normally be omitted.

I. Identification: See Section: MECHANICAL IDENTIFICATION.

3.04 ROOF AND DECK PENETRATIONS

A. Vent pipes projecting through the roof or waterproof deck: See Section: PLUMBING.

B. Pipes and Ducts Passing Through Roof:

1. Built Up Roofing:
   a. Provide sleeves, pitch pans, and flashing compatible with the roofing system.
   b. Extend pitch pan and pitch pocket bases 12" in each direction.
   c. Extend pitch pan and pitch pocket 6" above the roof flood line.
   d. Flash into the roofing waterproofing.
   e. Fill pitch pans and pitch pockets with hot poured roofing compound.
2. Metal Deck Systems and Other Proprietary Roofing Systems: Provide products manufactured by and methods approved by the roofing system supplier.
3. Submit shop drawings approved by the roofing supplier.

C. Submit Shop Drawings. Coordinate with Roofer.

3.05 ELECTRICAL

A. Connections: See Division: ELECTRICAL.

B. Disconnects and Motor Controllers (Starters): Provide as specified in Division: ELECTRICAL, except where such controllers or devices are part of or integral to or within equipment or are otherwise indicated. Refer to Section: MOTOR CONTROLLERS.

C. Protection: Where motor is not internally protected or has no controller indicated elsewhere, provide NEMA-rated, heater-protected magnetic motor controller; if motor has no requirement

for automatically controlled starting and stopping, provides NEMA-rated, heater-protected manual motor controller.

3.06 SLEEVES

A. Location: Provide sleeves for pipes, conduits, and other service lines exiting, entering, or passing through walls, roof or floors where placement of pipes, conduits and other service lines must be subsequent to construction of walls, roofs or floors.

B. Set plastic thimbles in form-work where sleeves are required or indicated through poured-in-place concrete; do not cut through concrete for sleeves.

C. Shop Drawings: Show sleeves and sleeve type.

D. Interior Walls and Floors: PVC pipe, Schedule 40, flush with walls minimum 1/4” and maximum of 1” clearance packed with foamed urethane rods.

E. Exterior Walls and Floors, Below Grade: PVC pipe, Schedule 40, flush with walls, :" above floors, cast in place. Fill annular ring with **Link-Seal** bolted rubber link type sleeve seal, installed as recommended by manufacturer, electrically isolating the metallic pipes from the structure.

F. Through membrane: Provide membrane clamping fitting, threaded or caulked.

G. Insulation:

1. On Pipe and Duct Below 65 deg F and Over 180 deg F:
   a. Provide 16 gauge galvanized sleeve over insulation at sleeves through exterior walls and caulk the joint both sides of wall.
   b. Seal transverse joints in insulation at wall surface.
2. On Pipe and Duct 70E F to 180E F:
   a. Discontinue at penetration.
   b. Seal insulation both sides of wall.
   c. Provide sleeve as specified above.

H. Through Roofs: See Paragraph: ROOF AND DECK PENETRATIONS.

3.07 FLOOR AND CEILING PLATES:

A. Provide chrome or galvanized steel escutcheons for exposed pipes exiting, entering, or passing through floor, ceiling or walls.

B. Plates in finished rooms or over plated pipe: Polished chromium plated brass.

3.08 CUTTING AND PATCHING

A. Bore, drill, saw, and otherwise provide openings for piping, ducts, sleeves, and other elements of the mechanical systems.

1. In Masonry: Use drills, core drills, or masonry saws; do not use impact equipment unless requested and approved by the Architect-Engineer.
2. Pre-Cast Concrete: Use drills, core drills, or masonry saws; do not use impact equipment unless requested and approved by the Architect-Engineer. Cut to exact size; submit shop drawing for approval.
3. With Tensioned Cable Reinforcing in Concrete:

a. Submit shop drawings of proposed locations and method of cutting.
b. Do not proceed until shop drawings are approved.
c. Do not cut cable reinforcing.

4. Poured-in-Place Concrete: Provide thimbles as specified in Paragraph: SLEEVES. Where indicated or otherwise Approved, cut same as indicated above for Pre-Cast Concrete; submit Shop Drawings.
5. Wood, Metal, Plastic, Pre-formed Boards: Drills or saws.
6. Other Substrates: Submit shop drawings.

B. Patching: Restore material surrounding the cut opening to as-new condition. Match remaining surrounding materials and finishes. Provide escutcheons as specified in Paragraph: FLOOR AND CEILING PLATES.

C. Roof Penetrations: Provide sleeves, pitch pans, and flashing compatible with the roofing system. Submit shop drawings approved by the roofing supplier. See Drawings for details.

3.09 IDENTIFICATION

A. See Section: MECHANICAL IDENTIFICATION.

3.10 TESTING AND INSPECTION

A. Perform all tests specified in Division 15, or as required by the Engineer or by the Local, Federal, and State Bureaus or Agencies having jurisdiction and under the supervision during the progress and upon completion of the work.

B. Include all costs for tests in your bid or proposal.

C. Provide all apparatus, temporary systems or components and all other requirements for satisfactory completion of the test.

D. Take all due precautions to prevent damage to the building or to its components and contents incurred by such tests as the Contractor will be responsible for any and all damages. The Contractor will be required to repay and make good any damage so caused at his own expense.

E. Contractor shall immediately repair any leaks, defects or deficiencies discovered as a result of these tests. Repeat unit test requirements are in full compliance.

END OF SECTION 230501

SECTION 23 05 02 - SLEEVING

PART 1. - GENERAL

1.01 QUALITY ASSURANCE

A. Installer: Qualified with at least 5 years of successful installation experience on projects with work similar to that required for this project.

1.02 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit the following Product Data, Shop Drawings, and Samples.

Item	Prod Data	Shop Dwgs	Samples
Sleeves	X	X	
Sealants	X		
Clay Plugs	X		
Clamps, Couplings, Adapters	X		

C. Shop Drawings: Show sleeves and sleeve type.

D. Include manufacturer's instructions for each product with submittal.

E. Submit reports and other documents as required.

PART 2. - EXECUTION

2.01 COORDINATION

A. Clearances: Maintain clearances below finished grade to avoid exposed pipe or sleeves. Provide annular space clearance and or clearance with bottom of grade beam in accordance with the geotechnical report to avoid damage related to soil movement.

B. Alignment: Align piping and raceways of various systems.

C. Obtain prior approval from structural engineer before sleeving through grade beams, load bearing walls, or other structural elements.

2.02 SLEEVES

A. Location: Provide sleeves for pipes, conduits, and other service lines exiting, entering, or passing through grade beams, walls, roof or floors where placement of pipes, conduits and other service lines must be subsequent to construction of walls, roofs or floors.

B. Set plastic thimbles in form work where sleeves are required or indicated through poured in place concrete; do not cut through concrete for sleeves.

C. Interior Walls: PVC pipe, Schedule 40, flush with walls, 1/4" – 1” annular space to have closed cell backer rod. Fire caulk required at sleeves through rated walls, see below.

D. Floors: PVC pipe, Schedule 40, 1" above floors, 1/4" – 1" annular space to have closed cell backer rod, filled with BASF MasterSeal SL1 elastomeric sealant or equal following manufacturer's instructions. Fire caulk required at sleeves through rated floors, see below.

E. Exterior Walls and Floors, Below Grade: PVC pipe, Schedule 40, flush walls, 1" above floors, 3" clearance packed with foamed urethane rods, sealed watertight at both surfaces with permanent elastic polysulfide or silicon compound, electrically isolated from pipe passing through.

F. Rated Sleeves: Fire rated pipe sleeves and collars are required at all rated wall, floors, membranes and partitions. Provide approved firestop method for all rated penetrations:

1. Reference architectural plan for rating requirement and rated locations.
2. Sleeves shall be rated for the penetration type and hour rating of the assembly.
3. Provide collars and sleeves per UL requirements. Use HILTI CP643 / CP644 or equal where required, in available size.

G. Through membrane: Provide membrane clamping fitting, threaded or caulked.

H. Wall Penetrations and Insulation:

1. On Pipe and Duct Below 65 deg F and Over 180 deg F:
   a. Provide 16 gauge galvanized sleeve over insulation at sleeves through exterior walls and caulk the joint both sides of wall.
   b. Seal transverse joints in insulation at wall surface.
2. On Pipe and Duct 70 deg F to 180 deg F:
   a. Discontinue at penetration.
   b. Seal insulation both sides of wall.
   c. Provide sleeve as specified above.
3. Refer to section 23 07 00 - Mechanical Insulation for additional requirements related to insulation at sleeves.

I. Through Roofs: See Paragraph: ROOF AND DECK PENETRATIONS.

J. Interior Walls: CPVC pipe, flush with walls, 1/4" – 4" annular space to have closed cell backer rod, filled with BASF MasterSeal MP1 elastomeric sealant or equal following manufacturer's instructions. Fire caulk required at sleeves through rated floors, see below. **Use of sealants containing Phosphate Esters is specifically prohibited.**

2.03 FLOOR AND CEILING PLATES:

A. Provide chrome or galvanized steel escutcheons for exposed pipes exiting, entering, or passing through floor, ceiling or walls.

B. Plates in finished rooms or over plated pipe: Polished chromium plated brass.

2.04 CUTTING AND PATCHING

A. Bore, drill, saw, and otherwise provide openings for piping, ducts, sleeves, and other elements of the mechanical systems.

1. In Masonry: Use drills, core drills, or masonry saws; do not use impact equipment unless requested and approved by the Architect-Engineer.

2. Pre-Cast Concrete: Use drills, core drills, or masonry saws; do not use impact equipment unless requested and approved by the Architect-Engineer. Cut to exact size; submit shop drawing for approval.
3. With Tensioned Cable Reinforcing in Concrete:
   a. Submit shop drawings of proposed locations and method of cutting.
   b. Do not proceed until shop drawings are approved.
   c. Do not cut cable reinforcing.
4. Poured-in-Place Concrete: Provide thimbles as specified in Paragraph: SLEEVES. Where indicated or otherwise Approved, cut same as indicated above for Pre-Cast Concrete; submit Shop Drawings.
5. Wood, Metal, Plastic, Pre-formed Boards: Drills or saws.
6. Other Substrates: Submit shop drawings.

B. Patching: Restore material surrounding the cut opening to as-new condition. Match remaining surrounding materials and finishes. Provide escutcheons as specified in Paragraph: FLOOR AND CEILING PLATES.

C. Roof Penetrations: Provide sleeves, pitch pans, and flashing compatible with the roofing system. Submit shop drawings approved by the roofing supplier. See Drawings for details.

2.05 ROOF AND DECK PENETRATIONS

A. All roof penetrations must conform to the roofing manufacturer’s requirements.

B. Vent pipes projecting through the roof or waterproof deck: Flash with four-pound-per-square-foot sheet lead extending 10" away in all directions, turned into the top of the pipe a distance of at least 1". Extend vent pipes 12" above top of roof.

1. Verify with Roofing Consultant.

C. Other pipes passing through roof or waterproof deck: Seal by a pitch-pocket, flashed into the waterproofing, filled with roofing pitch, and capped around pipes. Extend pitch pockets 12" above top of roof.

1. Verify with Roofing Consultant.

2.06 CLAY PLUG

A. Install a native clay plug in all utility trenches entering the building perimeter. This includes, and is not limited to water, storm, roof drainage, sanitary, fire sprinkler, electrical, telephone, communications, and plumbing piping.

B. All trenches must have a clay plug installed to reduce the transmission of ground water under slab on grade buildings and structural first floor buildings.

1. The plug must be installed at a distance of one foot beyond the face of the building foundation and be a minimum of one-foot wide.
2. The plug must extend 6” beneath utility trench into undisturbed soil. This portion of the clay plug must be installed prior to the installation of the utility pipe.
3. The plug must extend across the entire trench width and extend 6” into undisturbed soil beyond the trench width. Install native clay plug and the utility pipe at the same time.
4. The plug must extend to within 12” of finished grade. A clay plug cap consisting of native material. This clay plug cap shall fill the remaining 12” up to finished grade and be placed up to the edge of the building.

END OF SECTION 230502

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 230529 - FOUNDATIONS, HANGERS, AND SUPPORTS, HVAC

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work to be included in this section is as follows, but is not limited thereto:

1. Hangers and supports for piping and equipment.
2. Concrete supports for piping and equipment.

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of equipment of this type whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with work similar to that required for this project.

C. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

D. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS) Standards: Provide hangers and supports that comply with the following MSS Standards:

1. SP-58-1983, Pipe Hangers and Supports - Materials, Design and Manufacture.
2. SP-69-1983, Pipe Hangers and Supports - Selection and application.
3. SP-89-1985, Pipe Hangers and Supports - Fabrication and Installation Practices.
4. SP-90-1980, Guidelines on Terminology for Pipe Hangers and Supports.

E. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

F. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of

sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:

a. All warranties, guarantees and manufacturer's direction on equipment and material covered by the Contract.
b. Approved fixture/equipment brochures
c. Copies of approved Shop Drawings
d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
e. Any and all data and/or plans required during construction.
f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

G. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

H. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

I. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction, coordinate changes made by Utility Companies or Agencies

to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.03 SUBMITTAL

A. Submit manufacturer's technical product data including capacity ratings and application recommendations.

B. Shop Drawings:

1. Submit drawings indicating:
   a. Dimensions and loadings.
   b. Layout.
   c. Mountings and supports.
   d. Spatial relationship to associated equipment and nearby barriers.
2. Submit shop drawings of concrete bases and foundations.

PART 2. - PRODUCTS

2.01 CONCRETE FOUNDATIONS (PADS)

A. Pour concrete foundations (pads) for the support of equipment such as floor-mounted panels, pumps, fans, etc., not less than 4" high and extended 6" beyond all sides of the mounted equipment unless otherwise noted. Provide forms built of new-dressed lumber. Neatly chamfer corners of the foundations:" wide by means of sheetmetal or triangular wood strips nailed to the form. Place foundation bolts in the forms when the concrete is poured, correctly locating the bolts by means of templates. Set each bolt in a sleeve of size to provide 2" clearance around it. Allow 1" below equipment base for alignment and grouting. After grouting, remove the forms and hand rub the surface of the foundations with carborundum. Provide foundations for equipment located on the exterior of the building as indicated. Submit shop drawings of the foundations for review.

2.02 PIPE SUPPORTS, HANGERS, INSERTS, ANCHORS, AND GUIDES

A. General: Provide pipe supports, hangers, inserts, anchors and guides for all vertical and horizontal piping; comply with ANSI B31.1 Code for Pressure Piping and conform to MSS SP-58 and SP-69, except as specified below.

B. Finish: ASTM A164-71, 0.0005" electro-galvanizing plus gold zinc dichromate barrier formed on the zinc; finish type RS for threads, type LS for all other.

C. Inserts: Type 18.

D. Hangers: Type 1, 9, 10, or 11, adjustable or provided with turnbuckles, Type 13 or 15. Type 6 hangers may be used to support pipes from toilet rooms to main stacks when space does not permit the use of turnbuckles or adjustable clevis type hangers.

E. Light Duty Clevis Hangers: Conform to NFPA No. 13.

F. Brackets for Support of Piping at Walls: Type 31, 32, 33, or 34.

G. Slide Plates: Provide metallic pipes supported on beams or brackets with a graphite or polytetrafluoroethylene (PTFE) slide plate and cradle having a minimum thickness of 2"; Type 35.

H. Beam Clamps: Types 20, 21, 22, 23, 28, or 29. Provide a retainer with Type 23.

I. Angle Iron or Channel Clamps: Type 20 with a malleable iron heel plate added.

J. Provide auxiliary steel required for supports, anchors, guides, and other similar devices in addition to what is indicated on the Drawings or is specified here or elsewhere.

K. Review Drawings, including Structural Drawings, for details regarding pipe supports, anchors, hangers, and guides.

L. Provide pipe supports of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

M. Rod sizes indicated are minimum sizes only. Maintain structural integrity of all supports, anchors, guides, and other similar devices. Provide structural hanging materials with a safety factor of 5.

N. Locate and construct anchor points indicated on Drawings or as required to permit the piping system to take up its expansion and contraction freely in opposite directions, away from the anchored points.

O. Construct and locate guide points wherever required or indicated on drawings and at each side of an expansion joint or loop, to permit free axial movement only.

P. Fasten pipe supports, hangers, anchors and guides to the structure only at points where the structure is capable of restraining the forces in piping system.

Q. Isolate copper or brass lines from ferrous metals with c" thick sheet polyethylene dielectric material.

R. Provide other special types of foundations, hangers, or supports where so specified or indicated on the Drawings, or where required by the particular conditions; submit shop drawings for approval.

S. Properly size each hanger to fit the supported pipe or to fit the outside of the insulation on insulated lines.

1. Hangers for dual or low temperature insulated pipes: bear on the outside of the insulation.
2. Protect the insulation at bearing point from crushing by galvanized steel shields circling a minimum of 1/2 the insulation and extending a minimum of 6" on each side of the hanger.
3. Provide a rigid section of insulation to be installed at hanger points.
4. Encase hangers for high temperature and all insulated hot and cold domestic water pipes in the insulation unless supported by trapezes.
5. Where supported by trapezes, provide shield and rigid insulation as specified above for low temperature insulated pipes.
6. Provide shield gauges as follows:

Pipe or Insulation Diameter	**USS Gauge**
Up to 3"	No. 22

3" thru 6"	No. 16
Above 6"	No. 12

T. Hanger Rods:

Pipe Size	**Rod Diameter**
4" and smaller	3/8"
5" thru 8"	1/2"
10" thru 12"	5/8"
14" thru 16"	3/4"

U. Supports for vertical piping: Type 42 double bolt riser clamps with each end having equal bearing on the building structure; locate at each floor.

V. Supports on Vertical Surfaces for Horizontal Piping: Type 24 U-bolt on drilled steel channel (or manufacturer's proprietary 2-piece snap-in bolted product). Use only to support pipe from vertical surfaces or members where lines are not subject to expansion or contraction.

W. Do not use perforated strap or ferrous wire for hanger material.

X. Isolate copper or brass lines from ferrous metals with dielectric material to prevent corrosion.

Y. Type 2, Floor-Mounted Equipment

1. Vibration isolators shall be free standing, unhoused, laterally stable springs wound from high strength spring steel. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections shown on the Vibration Isolation Schedule or as indicated on the project documents. Springs shall be color coded or otherwise identified to indicate load capacity. In capacities up to 5,000 lbs., springs shall be replaceable. In capacities over 5,000 lbs., springs shall be welded to the top and bottom load plate assemblies. Springs shall be assembled between a top and bottom steel load plate. The upper load plate shall be provided with a steel leveling bolt lock nut and washer for attachment to the supported equipment. The lower load plate shall have a non-skid noise isolation pad bonded to the bottom and have provisions for bolting the isolator to the supporting structure.
2. Spring isolation mounts for floor-mounted equipment shall be Model FDS, as manufactured by Kinetics Noise Control.

2.03 PIPE SUPPORTS, HANGERS, INSERTS, ANCHORS, AND GUIDES (PLASTIC PIPING)

A. General: Same as for metal except: **Hangers: Vee Bottom Clevis Hanger, adjustable or provided with turnbuckles, B-Line Systems with Plastic Pipe Support Channel.**

2.04 PIPE SUPPORTS IN CHASES AND PARTITIONS

A. Support horizontal and vertical piping in chases and partitions by hangers or other suitable support.

B. Securely support pipes serving plumbing fixtures and equipment near the point where the pipes penetrate the finish wall.

C. Provide supports of steel plate, angles or special channels such as Unistrut mounted in vertical or horizontal positions.

D. Attach pipe clamps such as **Unistrut P2426, P2008, P1109** or other approved clamps to supports.

E. Attach supports to wall or floor construction with clip angles, brackets, or other approved method.

F. Supports may be attached to cast iron pipe clamp, No. 9 black soft annealed wire, or other approved method.

PART 3. - EXECUTION

3.01 ATTACHMENT

A. Do not exceed the safe and allowable load and spacing on any hanger, insert, or any component of the support system, including the substrate and the concrete which holds the inserts. Provide reinforcement at inserts as required to develop the necessary strength.

B. Provide inserts for piping supports of a type which will not interfere with reinforcing and which will not displace excessive amounts of structural concrete. Do not interfere with reinforcing.

C. Design and install pipe support to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, and other similar devices.

D. Install piping with due regard for expansion and contraction, the type of hanger, method of support, location of support, and other similar circumstances.

E. Attach pipe hangers to the structure as follows:

1. **Refer to structural drawings for additional support requirements.**
2. Poured in place concrete:
   a. Where pipes and equipment are supported under poured in place concrete construction, fit each hanger rod with a nut at its upper end, set into an Underwriter's Laboratories, Inc., listed universal concrete insert placed in the formwork before concrete is poured.
   b. Where inserts are placed in the bottom faces of concrete joists which are too narrow to provide adequate strength of concrete to hold the insert properly or where a larger insert would require displacement of the bottom joist steel, suspend the hanger rod from the center of a horizontal angle iron channel, iron I-beam, or other similar device, spanning across two adjacent joists.
   c. Bolt the horizontal support to non-adjustable concrete inserts of the "spot", type, of physical size small enough to avoid the bottom joist steel.
3. Poured-in-Place Joists: Same as above except do not install inserts.
4. Steel Beams:
   a. Where pipe and loads are supported on steel beams, use approved type supports.
   b. Where pipe and loads are supported under steel beams, use approved type beam clamps.
5. Wood Framing: Where pipe and loads are supported from wood framing, attach hanger rod to framing with side beam brackets or angle clips.
6. Precast Double Tee Structural Concrete:
   a. Install hangers, supports, anchors, and other similar devices required for mechanical systems attached to the precast, double tee, structural concrete system in accordance with approved shop drawings only.
   b. Core drill holes required for hanger rods in the "flange" of the double tee only; do not use impact type tools. Do not core drill in the "stem" portion of the double tee.

c. Core drill holes through the "flange" for hanger rods no greater than 3" larger than the diameter of the hanger rod.
d. Support hanger rods by means of bearing plates of size and shape acceptable to the Architect-Engineer, with welded double nuts on the hanger rod above the bearing plate.
e. Cinch anchors, lead shields, expansion bolts, and studs driven by explosive charges are not allowed under any circumstances in the lower 15" of each stem and in the "shadow" of the stem on the top side of the "double tees".

7. Other Already-Hardened Concrete: Submit Shop Drawings.

3.02 SPACING

A. Locate hangers supporting horizontal lines to prevent appreciable sagging of these lines.

B. Support cast iron lines with hangers spaced 5'-0" on centers, with a minimum support of one hanger per joint or fitting.

C. Support pipes in accordance with ANSI B31.1.

D. The following table gives maximum hanger spacing for copper and steel lines.

Size of Line	**Hanger Spacing, Feet**
¾" and smaller	6
1" thru 1-½"	8
2" thru 2-½"	10
3" and larger	12

E. Space hangers more closely where required by the conditions of the installation in order to prevent sagging, excess load on structures and hangers, undue strain on equipment, noise transmission, and other similar circumstances.

F. Place a hanger within 2' of each elbow or tee.

3.03 TRAPEZES

A. Where multiple lines are run horizontally at the same elevation and grade, support on trapezes made by **Kindorf, Elcen** or equal, channel suspended on rods or pipes.

B. Properly size trapeze members including suspension rods for the number, size, and loaded weight of the lines they are to support.

3.04 DUCTWORK

A. Support ductwork in accordance with the SMACNA recommendation for the service involved; support horizontal ductwork at intervals not to exceed 8'-0".

B. Support horizontal ducts using galvanized steel bands extending up both sides and up to the construction above.

C. Turn bands over and secure with bolts into nuts fitted into the inserts in the concrete, bolt to angles secured to the construction above, or secure in another approved manner.

3.05 MISCELLANEOUS

A. Do not use chain straps, perforated bars or straps, wire hangers, or expansion shields.

B. Use UL listed hangers and supports for fire standpipe systems and fire sprinkler systems.

C. Provide any other foundations, hangers, and supports indicated on the Drawings, specified elsewhere within, or required by conditions at the site.

D. Provide hangers and supporting structures for suspended equipment as required to support the load from the building structure; submit shop drawings.

END OF SECTION 230529

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 230550 - MECHANICAL EXCAVATION

PART 1. - GENERAL

All BACKFILL PROCEDURES AND MATERIALS SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT RECOMMENDATIONS.

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE:

A. Coordination: Where excavation and backfill for mechanical work passes through or occurs in the same areas as work specified in the Division 2 sections, comply with both the requirements of the Division 2 sections and the requirements of this section, whichever is the more stringent (as determined by the Architect/Engineer in cases of conflicting requirements).

1.03 JOB CONDITIONS:

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

PART 2. - PRODUCTS

2.01 BACKFILL MATERIALS

A. Subbase Material: A graded mixture of gravel, sand, crushed stone or crushed slag.

PART 3. - EXECUTION

3.01 EXCAVATING:

A. Inspection: The excavator must examine the areas to be excavated, and the conditions under which the work is to be performed and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with excavating until unsatisfactory conditions have been corrected in a manner acceptable to the excavator.

B. General:

1. Do not excavate until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimum.
2. Provide signs, illuminations and barricades as necessary to prevent accidents at excavations.
3. Excavate with vertical sided excavations to the greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at a sufficient distance below finished grade to not interfere with other work.

4. Excavate for piping with 6" to 9" clearance both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Provide a minimum of 12" clearance around underground tanks.
5. For work to be supported directly on undisturbed soil, do not excavate beyond required depths, and hand excavate the bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at the bottom of the excavations:
   a. Piping of 5" and less pipe/tube size.
   b. Cast-in-place concrete.
6. Where directed, excavate additional depth to reach satisfactory soil-bearing conditions. Backfill with subbase material compacted as directed, to indicate excavation depth.
7. Except as otherwise indicated, excavate for exterior water-bearing piping so that the top of piping will not be less than 2'- 0" vertical distance below finished grade.
8. Store excavated material (temporarily) near the excavation, in a manner which will not interfere with or damage the excavation or other work.
   a. Retain excavated material which complies with the requirements for backfill material.
   b. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirement for backfill material.

3.02 DEWATERING:

A. Maintain dry excavations by removing water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations from being damaged by water, sediment or erosion from or through excavations.

3.03 BASE PREPARATION:

A. Install subbase material to receive fire protection work, and compact by tamping to form a firm base for the work. For piping, shape the subbase to fit the shape of the bottom 90 degrees of the cylinder, for uniform continuous support.

B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanges connections, valves and similar enlargements in the piping systems.

3.04 BACKFILLING:

A. Do not backfill until installed work has been tested and accepted, wherever testing is indicated.

B. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

C. Backfill simultaneously on opposite sides of work, and compact simultaneously; do not dislocate the work from installed positions.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.

1. Lawn/Landscaped Areas: 90%
2. Roadways: 95%
3. Paved Area, Other than Roadways: 95%

E. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

F. Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by the Architect/Engineer.

3.05 PERFORMANCE AND MAINTENANCE:

A. Where subsidence is measurable or observable at fire protection work excavations during the guarantee period, remove the surface (pavement, lawn or other finish), add backfill material, compact and replace the surface treatment. Restore the appearance, quality and condition of the surface or finish to match adjacent work and eliminate evidence of the restoration to the greatest extent possible.

END OF SECTION 230550

SECTION 230553 - HVAC IDENTIFICATION

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of the Work is indicated on the Drawings, and by the requirements of this section, and is hereby defined to include the following identification:

1. Hazardous material piping system identification.
2. Piping systems.
3. Piping system devices (valves, thermometers, pressure gauges, etc.):
4. Mechanical equipment.
5. Ductwork.

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of equipment of this type whose products of this type have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with Work similar to that required for this project.

C. ANSI Compliance: Provide components conforming to ANSI A13.1.

D. Acceptable Manufacturers:

1. Seton.
2. Brady
3. Kolbi

1.03 SUBMITTAL

A. Submit data indicated in Section: GENERAL REQUIREMENTS, HVAC.

B. Submit list of all products incorporated into the Work.

C. Submit the following Product Data, Shop Drawings, and Samples.

Item	Prod Data	Shop Dwgs	Sam-ples
Hazardous system markers	X	X	
Piping system color-coding	X		
Device tags	X	X	
Device charts	X	X	
Equipment labels	X	X	

D. Include manufacturer's instructions for each product with submittal.

E. Submit reports and other documents as required.

PART 2. - PRODUCTS

2.01 IDENTIFICATION PRODUCTS

A. Hazard Markers for Pipe-Conveyed Material:

1. Conform to ANSI A13.1 for classification of hazards of materials.
2. Use markers of the following colors to identify the materials conveyed by the pipes:

	Material	Field	Letters
a.	Inherently Hazardous:	Yellow	Black
b.	Inherently Low Hazard:		
(1)	Liquid or Liquid Admixture:	Green	White
(2)	Gas or Gaseous Admixture:	Blue	White
c.	Fire Quenching Materials:	Red	White

3. Provide pipe markers with the following features.
   a. Letters from 2" to 3" size letters to afford readability from the appropriate viewing position.
   b. Repeated and reversed words for viewing from 360 degrees around pipe.
   c. Self-clinging, coiled markers that snap into place around pipe and do not require any other securement.
   d. Integral directional arrows.
4. Letters on Field: Identify the specific material conveyed, e.g., "Domestic Cold Water", "Sprinkler", etc.
5. Model:
   a. Less than 1/2": Tags, same as Paragraph: Piping System Devices, color codes for hazard.
   b. 1/2" up to 6"; **Seton Setmark SNA** snap-on.
   c. Over 6"; **Seton Setmark STR** strap-on, with stainless steel spring straps.
6. Self-adhesive markers are acceptable if affixed at each end with minimum 2” overlapping plain or arrow tape.

B. Piping System Devices (Valves, Thermometers, Pressure Gauges, etc., and Pipe Less Than :"): Identify with the following.

1. Tags: Not less than 1-1/2" brass or aluminum tags, round, square, or octagonal.
2. Stamp tags with minimum 1/4" high descriptive characters, 1/2" high numbers, with black enamel-filled indentations.
3. Tag Model: **Seton 250-BL, 300-BL, SVT-15BL, SVT-20BL, OVT-20BL, or XVT-15BL**.
4. Attachment: Stainless steel or solid brass jack chain; **Seton JA16**, or stainless steel or brass "S" hooks; **Seton S10, S20, or S30**.

C. Equipment labeling:

1. Provide engraved, laminated plastic nameplates, 1/16" thick, 3-layer, white letters on black background, 3/16" letter height, beveled edges, drilled for 2- #3 screws.
2. Attach with corrosion-resistant self-tapping screws or corrosion-resistant pop-rivets.
3. Model: **Seton style 2060-20, 2062-25, 2060-30, 2060-40**.
4. For ERV units provide label for all air stream ducts labeled as per plans for OA, RE, FA & EA. Attach label to unit at duct connection clear of insulation.
5. At all HVAC Filter locations above ceiling for both ERV and WSHP (not including return grill locations) Provide engraved, laminated plastic namesplates, 1/16” thick, black letters on white 1” tall background, ½” letter height, labels to be permanently fastened on ceiling grid below the filter. Label to read “FILTER”.

6. At all Fire Damper locations, provide engraved, laminated plastic namesplates, 1/16" thick, red letters on white 1" tall background, ½" letter height, labels to be permanently fastened on ceiling grid below the damper. Label to red "FIRE DAMPER".

D. Ductwork.

1. Stenciled letters or self-adhesive labels, minimum 1" high characters.

E. Underground Warning Tapes:

1. Provide materials that meet the codes or have the approvals listed below:
   a. Office of Pipeline Safety Regulation, USAS Code B31.8.
   b. GSA Public Building Service Guide Specification.
   c. National Transportation Safety Board Report NTSB-PSS-73-1.
   d. AGA Report 72-D-56.
   e. API Report API RP 1109.
2. Material: Plastic, continuous tape, color-coded, marked for hazard.
   a. For Non-metallic Piping System: Aluminum foil core encased in plastic.
   b. Metallic Piping: Plastic tape.
3. Color: Colored (not printed color) plastic, coded for material conveyed by piping.
4. Width: As scheduled for piping system burial depth.
5. Legend: "Caution [System Name] Line Buried Below".
6. Tape Colors:

Utility	**Color**
Electric	Safety Red
Gas, Oil, Dangerous Materials	Hi Visibility Safety Yellow
Communications	Safety Alert Orange
Water Systems	Safety Precaution Blue
Sewer Systems	Safety Green

7. Model:
   a. Metallic Piping System: **Allen Systems Markline**.
   b. Non-Metallic Piping System: **Allen Systems Detectatape**.

F. Fire and Fire/Smoke Dampers:

1. Provide engraved, 2 ½ x ¾" plastic laminate, single layer, red letters on white background, 1/4" letter height, securely mounted (riveted) on ceiling grid below each damper location.

G. **Pipeline Markers for Pipe Beneath Pavement and Slabs**.

1. Minimum 2" round, square, or octagonal, same as specified in Subparagraph: Piping System Devices.
2. Attachment:
   a. 1-1/2" screw, bolted to tag as anchor.
   b. Anchor Setting Compound: Epoxy or epoxy grout, compatible with the pavement.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Complete installation in accordance with ANSI A13.1 and manufacturer's installation instructions and with the Drawings. Fasten each unit securely in place.

B. Hazard Markers for Pipe-Conveyed Material:

1. Location:
   a. In crawl spaces.
   b. Where exposed beneath suspended slabs.
   c. Outside above grade.
   d. Above roofs.
   e. Above lay-in ceilings
   f. Other places where pipe is exposed in occupied rooms and spaces, indoors and outdoors.
2. Spacing:
   a. Where pipe passes through walls, floors, and other barriers.
   b. In Tunnel Vaults and Equipment Rooms: Maximum spacing, 10'; closer where piping is congested, and where piping continuity is obscured from view.
   c. Piping in Tunnels: Maximum spacing 100'.
   d. Other Places: Maximum spacing 50'.

C. Piping System Color Coding:

1. Designate for painter the following:
   a. Types of piping services.
   b. Direction of flow.
   c. Other information required for proper identification.
2. Surfaces to be Painted:
   a. Bare piping.
   b. Insulation covering of insulated piping.

D. Piping System Devices (Valves, Thermometers, Pressure Gauges, etc.):

1. Identify with the following information:
   a. System.
   b. Device number.
   c. Device function.
2. Device Chart:
   a. Key devices to device chart.
   b. Give complete description of device function and system.
3. Key devices to drawings as follows:
   a. Floor plans.
   b. Schematic drawings of piping systems.

E. Equipment labeling:

1. Install on scheduled items of equipment, including the following:
   a. Water heaters.
   b. Air conditioning equipment.
   c. Pumps.
   d. Control panels and major control components.
   e. Other items of equipment.
   f. Include Mark Number and descriptive name from Drawing and Specification schedules.

F. Ductwork.

1. Identify in the following locations:
   a. Equipment rooms.

G. Underground Warning Tapes:

1. Tape Widths:

Piping Burial Depth	Tape Width
10"	2"
20"	3"
27"	6"
30"	9"
40"	12"
50" or more	18"

2. Recommended Tape Bury Depth:
   a. Minimum Depth: 6".
   b. Distance Between Pipe and Tape: Minimum 12".
   c. Maximum Depth: 12".
3. Tie tape to pipe where pipe leaves the ground.

H. Pipeline Markers for Pipe Beneath Pavement and Slabs.

1. Location:
   a. Accuracy: Plus, or minus 6" from piping center line.
   b. Flat Edge Pavement and Slabs: Set within 6" of pavement or slab edge.
   c. Concrete Curbs: Set in top of curb.
   d. Spacing: Each change in direction, each edge of pavement or slab, maximum spacing of 100'.
2. Legend: Same as tags plus an engraved or stamped line; set marker with line parallel to buried line.
3. Attachment: Drill hole for anchor bolt, full depth of bolt plus 2"; set full tag and bolt in epoxy, flush with pavement or slab.

END OF SECTION 230553

SECTION 230593 - TEST-ADJUST-BALANCE

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of test-adjust-balance (TAB) work is indicated by the requirements of this section, and also by drawings and schedules.

B. TAB Work: Defined to include, but is not necessarily limited to:

1. Examine the Drawings to determine if necessary gauge connections, thermometer wells, flow measuring devices, and other test ports have been called for; if not, notify the Contractor and the Architect-Engineer in a timely manner describing the deficiencies.
2. Conduct tests.
   a. Flow rates.
   b. Equipment capacities.
3. Adjust volume (flow) adjusting facilities (dampers, balancing valves, etc.) provided for the systems.
4. Record data.
5. Prepare and submit reports to the Contractor and the Architect-Engineer.
6. Recommend modifications to the Work as installed; recommend modifications to the Contract Documents.

C. Type of Systems to be Tested:

1. Air systems and associated equipment and apparatus.
2. Hydronic systems and associated equipment and apparatus.

D. Test-Adjust-Balance the following systems and components:

1. Fans.
2. Air Conditioning Units:
   a. Rooftop Units
3. Ductwork systems.
4. Exhaust and ventilation systems.
5. Pumps.

1.02 QUALITY ASSURANCE

A. TAB Firm: Comply with one of the following:

1. A firm certified by the Associated Air Balance Council (AABC) in those testing and balancing disciplines similar to those required for this project.
2. A firm certified by the National Environmental Balancing Bureau (NEBB), qualified and capable, using personnel qualified and capable in those testing and balancing disciplines similar to those required for this project and who is not Installer of systems to be tested.

B. Procedural Standards: Comply with one of the following standards:

1. NEBB's "Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems" as applicable to HVAC air and hydronic distribution systems and associated equipment and apparatus.

2. AABC's "National Standards Fourth Edition, 1982, as applicable to HVAC air and hydronic distribution system and associated equipment apparatus.
3. ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.) recommendations pertaining to measurements and testing, adjusting and balancing, except as otherwise indicated.

1.03 SUBMITTAL

A. Submit copy of proposed testing procedures and report forms.

B. Submit reports as specified elsewhere.

PART 2. - PRODUCTS

2.01 PATCHING

A. Except as otherwise indicated, use same products as used by the original installer for patching holes in insulation, ductwork and housing which have been cut or drilled for testing purposes, including access for test instruments, attached jigs, and similar purposes.

B. At tester's option, use plastic plugs with retainers to patch drilled holes in ductwork housing.

2.02 TEST INSTRUMENTS

A. Utilize test instruments and equipment for the TAB work required, of the type, precision and capacity as recommended in the following standards:

1. NEBB's Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems.
2. AABC's National Standards for Total System Balance, for Field Measurements and Instrumentation.

PART 3. - EXECUTION

3.01 INSPECTION

A. Readiness for TAB work:

1. Examine the Drawings, the installed work, and conditions under which testing is to be done to ensure that necessary gauge connections, thermometer wells, and other test ports have been provided, and that work has been completed, cleaned, and is operable.
2. Do not proceed with testing, adjusting, and balancing work until the work to be TAB'ed has been completed and is operable.
3. Ensure that there is no latent residual work still to be completed.
4. Do not proceed until the necessary gauge connections, thermometer wells, and other test ports have been installed.
5. Do not proceed until the work scheduled for TAB is clean and free from debris, dirt, and discarded building materials.
6. Do not proceed with the TAB work until unsatisfactory conditions have been corrected.

B. Notify the Contractor and the Architect/Engineer in writing of conditions detrimental to the proper completion of the test-adjust-balance work.

3.02 TAB PROCEDURE

A. Standards: Test, adjust, and balance the systems and components, as indicated, in accordance with the procedures outlined in the applicable Specification Sections, in the referenced Procedural Standards, and in this Section.

B. Capacity Tests:

1. Conduct tests of primary and secondary heating and cooling equipment and their auxiliary equipment to determine if equipment capacity equals or exceeds the scheduled or specified or otherwise indicated equipment capacity requirement.
2. Measure and record Btu/hr, gallons per minute (gpm), air flow rate (cfm), air-side pressure drop, water-side pressure drop, and other pertinent data; compile recorded data, calculate unit capacity, and indicate in report if unit capacity is less than, equals, or exceeds the scheduled capacity.

C. Seasonal TAB: Test, adjust, and balance the system during the summer for air conditioning systems, during the winter for heating systems, including at least a period of operation at outside conditions within 5 deg F wet bulb temperature of maximum summer design condition, and within 10 deg F dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring the final temperatures then take the final temperature readings when the seasonal operation does permit.

D. Prepare report of the test results, including instrumentation calibration reports, in format recommended by the applicable standards. State in test reports when components or systems do not meet scheduled requirements.

E. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in a manner recommended by the original Installer.

F. Mark equipment settings, including controller positions, indicators, speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

G. Lock settings on memory-stop type balancing valves. Provide markings with paint or other suitable permanent identification materials on other similar air and water adjusting devices.

H. Prepare a report of recommendations for correcting performances when components or systems cannot be successfully adjusted and balanced; including, where necessary, modifications which exceed the requirements of the Contract Documents.

I. Retest, adjust and balance components and systems subsequent to modifications, and resubmit test results.

END OF SECTION 230593

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 230700 - HVAC INSULATION

PART 1. - GENERAL

1.01 QUALITY ASSURANCE

A. Acceptable Manufacturers:

1. Fiberglass Insulation:
   a. Owens-Corning Fiberglass.
   b. Johns-Manville.
   c. Knauff.
   d. CertainTeed.
2. Urethane Insulation, flexible:
   a. Owens-Corning.
   b. Armstrong (Armaflex).
   c. Johns-Manville
3. Urethane, Rigid (polyisocyanurate):
   a. Thermacor CTI.
   b. Alibaba
   c. Polynate Foams
4. Fiberglass Rigid-Flexible:
   a. SPI Rigidflex.
   b. Owens-Corning Fiberglass
   c. Polynate Foams
5. Mastics:
   a. Benjamin Foster.
   b. Insul-Coustic.
   c. Chicago Mastic.
   d. Childers Products.
6. PVC Fittings:
   a. Johns Manville
   b. Proto LoSmoke PVC.
   c. Alibaba

B. Installer's Qualifications:

1. A company that has insulated a minimum of five similar projects, of similar size and scope that have been in operation a minimum of two years.
2. Utilize only workers skilled in this trade to apply materials.

C. Apply materials only after substrate has been tested and cleaned.

D. Finish all insulation with material having a maximum flame spread rating of 25 under ASTM method 84.

E. Install non-compressible insulation material at hangers of cold piping to eliminate through-metal conductance.

F. Related Work: Sizing and paint, pipe shield or saddle, and internal duct insulation are specified in other Sections.

G. Vapor Barrier:

1. Provide minimum insulation thickness as scheduled, but sufficient to eliminate surface condensation on the cold-substrate insulation and to maintain a maximum exterior insulation surface temperature of 140°F on the hot-substrate insulation.
2. Vapor-seal insulation of all substrates which operate below 60°F.

1.02 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit the following Product Data, Shop Drawings, Samples, and manufacturer's certifications:

Item	Product Data	Shop Dwgs	Samples
Insulation	X		
Fitting covers	X		
Finishing materials	X		
Vapor barrier mastic	X		
Weather barrier mastic	X		
Adhesives	X		
Fittings, valves, and other irregular appurtenances	X		X
Duct sealant	X		

C. Include manufacturer's instructions for each insulation system with submittal.

D. Submit reports and other documents as required.

PART 2. - PRODUCTS

2.01 INSULATION TYPES

TYPE	K @	TEMP 75°F	LIMIT	SPEC PCF COMPLIANCE	R*
1. Calcium silicate	.38	1200	11	ASTM C533, Type I	2.6
2. Cellulose fiber	.26	350	3	ASTM C739	3.8
3. Fiberglass (rigid)	.23	450	3	ASTM C612, Type 1 B	4.3
4. Fiberglass pipe covering	.23	850	3	ASTM C547 Type I	
5. Flexible fiberglass blanket	.24	250	1.5	ASTM C1071, Type I	8.3
6. Foamed glass	.40	850	9	HH-1-551	2.5
7. Foamed plastic, flexible	.25	220	5.8	HH-1-573B	4.0
8. High temperature	.23	850	3	ASTM C612, Type II	4.3
9. Insulating cement	.70	1700	34	SS-C-160	1.4
10. Mineral wool	.23	1000	8	ASTM C612	4.3
11. Not used.					
12. Polystyrene	.24	170	1	HH-1-524B	4.3
13. Urethane foam rigid	.14	220	2	HH-I-530a Grade 2 Type 1 Class 1	6.3
14. Fiberglass rigidflex	.27	850		ASTM C1393 Type IIIA	

*R-Value: Provide insulation with R-Value indicated unless other thickness indicated elsewhere.

2.02 FITTINGS

A. Fitting Types:

1. Molded, of same material as insulation.

2. Inserts, of same material as insulation.
3. Loose fill mineral fiber.

B. Fitting Covers:

1. Preformed PVC fitting covers with fiberglass inserts.
2. Preformed fitting covers of same material as pipe covering.
3. Job built fitting covers of similar material as pipe covering.
4. Preformed PVC fitting covers with molded or fitted inserts of same material as pipe insulation.

C. Removable Covers:

1. Glass fiber blanket, enclosed in vapor barrier for cold systems, covered with stiched 8 oz. fiberglass canvas.
2. Aluminum eyelets, cord lacings.
3. Resistant to temperatures of substrate.
4. Install on valves, strainers, and other servicing and servicable devices in both hot and cold systems.

2.03 INSULATION FINISHES (EQUIPMENT, PIPE, FITTINGS & DUCT)

A. Finishes:

1. 8 oz. fiberglass canvas.
2. Insulation cement.
3. 0.016” aluminum with aluminum bands.
4. 15 mil PVC.
5. 30 mil ABS.
6. 1/4" weatherproof mastic with glass mesh reinforcement.
7. 1/16" vapor barrier mastic with glass mesh reinforcement.
8. White all service jacket (ASJ) (vapor barrier), foil-kraft laminate, self-sealing lap (SSL); Fed.Spec. HH-I-1751/4, Grade 1 or 2.
9. Foil reinforce kraft jacket (FRK) (vapor barrier), self-sealing lap (SSL).
10. Insulation manufacturer’s paint finish tinted as selected by Architect-Engineer.
11. 0.016" stainless steel.

2.04 ADHESIVES AND MASTICS SUPPLEMENT

A. Vapor Barrier Mastics:

1. White, polymeric, UL classified vapor barrier mastic to seal fittings; **Foster 30-35 or Childers CP-30**.
2. Black, asphaltic, UL classified vapor barrier mastic; **Foster 65-05, 06 or Talcote 025**.
3. Black, asphaltic vapor barrier mastic for underground or outdoor use (not UL classified); **Foster 60-25, 26 or Talcote 070**.

B. Weather Barrier Mastics:

1. White, elastomeric, UL classified outdoor grade, vinyl mastic for finishing outdoor insulation; **Foster 35-00 or Childers CP-10**.
2. Black, asphaltic emulsion, breathing mastic for underground or outdoor use (not UL classified); **Foster 90-07 or Lion Oil Sealkote**.

C. Adhesives:

1. Water based, polymeric, UL classified lagging adhesive for applying glass cloth; **Foster 30-36 or Childers CP-50**.
2. Fast setting, rubber based, UL classified, vapor barrier lap and attachment adhesive; **Foster 85-15 or Childers CP-85**.
3. Same adhesive, except non-flammable when wet; **Foster 85-20 or Childers CP-82**.
4. Rubber based, UL classified, fast setting contact adhesive for adhering flexible cellular insulation; **Foster 82-40 or Armstrong 520**.

D. Duct Sealants: Reference Specification Section: AIR SUPPLY AND DISTRIBUTION.

PART 3. - EXECUTION.

3.01 APPLICATION

A. General: Use mechanical fasteners whenever possible to assure permanent construction. Leave exposed insulation with a smooth, neat, paintable surface. Remove unsightly Work and replace with new materials.

B. Equipment:

1. Application:
   a. **E1**: Cut insulation to fit the contour of the equipment and secure by means of bands, stick clips, weld pins and lugs or adhesives as required for each individual piece of equipment.

C. Piping:

1. Application:
   a. **P1**: Butt insulation together; securely staple in place with outward clinching staples on 3" centers. Install factory furnished laps at the butt joints. Where insulation terminates, bevel and finish it neatly.
   b. **P2**: Butt insulation together; securely staple in place with outward clinching staples on 3" centers. Install factory furnished laps at the butt joints. Where insulation terminates, neatly bevel, apply vapor barrier mastic, and finish. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.
   c. **P3**: Butt insulation together and adhere in place with a contact cement. Where possible, slip tubing on without slitting. Where insulation terminates, neatly bevel and finish.
   d. **P4**: Butt insulation together and secure with mechanical fasteners. Fill all joints with insulation cement prior to insulation finish.
   e. **P5**: Butt insulation together and adhere in place with a contact cement. Maintain vapor barrier at joints equal to product's perm rating. Where possible, slip tubing on without slitting. Where insulation terminates, neatly bevel and finish.
2. Pipes Passing Through Sleeves:
   a. Continue insulation through the sleeve except at firewall penetrations.
   b. Provide an aluminum jacket with factory applied moisture barrier over the insulation wherever penetrations require sealing.
   c. Where Penetrating Interior Walls: Extend the aluminum jacket 2" beyond either side of the wall and secure on each end with a band.
   d. Where Penetrating Floors: Extend the aluminum jacket from a point below the backup material to a point 10" above the floor with one band at the floor and one not more than 1" from the end of the aluminum jacket.

e. Where Penetrating Waterproofed Floors: Extend the aluminum jacket from below the backup material to a point 2" above the flashing with a band 1" from the end of the aluminum jacket.
f. Where penetrating exterior walls: Continue the aluminum jacket required for pipe exposed to weather through the sleeve to a point 2" beyond the interior surface of the wall.

3. Where Penetrating Roofs:
   a. Insulate pipe as required for interior service to a point flush with the top of the flashing and sealed with vapor barrier coating.
   b. Butt the insulations for exterior application butt tightly to the top of flashing and interior insulation.
   c. Extend the exterior aluminum jacket 2" down beyond the end of the insulation to form a counter flashing.
   d. Seal the flashing and counter flashing underneath with caulking.

D. Insulation at Pipe Sleeves: Provide complete pipe sleeve unit meeting the following requirements:

1. Manufactured unit consisting of pouring sleeve, fireproof insulation, and fireproof packing.
2. Unit designed to create a fire and smoke barrier where the pipe passes through walls and floors.
3. Unit Materials:
   a. Insulation: Calcium silicate, 100 psi compressive strength, asbestos-free, water repellant.
   b. Jackets, sleeves, and flanges: ASTM A527 galvanized steel.
   c. Packing: Ceramic fiber, temperature limit of 2,400^{o}F.
4. Unit passes ASTM E119 tests.
5. Unit complies with UBC STD. No. 43-1.
6. Suitable for substrate temperatures of minus 20^{o}F to plus 1,200^{o}F.
7. Where Penetrating Roofs:
   a. Seal the flashing and counter flashing underneath with caulking.
8. Model: **Pipe Shields Incorporated Series F**.

E. Ductwork:

1. Application:
   a. **D1**: Apply fiberglass board insulation to duct with mechanical fasteners such as stick clips or weld pins spaced as required to install full pieces of board insulation (approximately 12" centers on bottom). Cover joints and seams in vapor barrier facing with 3" wide matching tape or with vapor barrier mastic reinforced with 3" glass mesh reinforcement. Where duct standing seams exceed the insulation thickness, provide an additional 4" wide layer of board.
   b. **D2**: Wrap flexible fiberglass insulation around ducts and secure with outward clinching staples. Ducts 24" wide and larger additionally secure with stick cups on 18" centers or with 4" wide bands of adhesive applied on 18" centers. Lap insulation a minimum of 4" and seal all seams and penetrations with an approved mastic reinforced with 3" glass mesh reinforcement. Seal all raw glass to duct where insulation terminates.
2. Ducts Passing Through Sleeves: Continuous through sleeves and prepared openings except at fire or smoke dampers in a firewall or fire partition penetrations, and unless otherwise indicated.
3. Duct Insulation Terminating at Fire Dampers, Diffusers, Registers and Grilles: Continuous over the surfaces of fire dampers, including the retaining angles, and the surfaces of diffusers, registers, and grilles exposed to unconditioned air.

4. Vapor Barrier Materials: Apply to form a complete unbroken vapor seal over the insulation passing through sleeves.

END OF SECTION 230700

SEE INSULATION SCHEDULE, FOLLOWING PAGE(S).

INSULATION SCHEDULE (Continued)

	Exposed Non-Conditioned Area	Exposed Conditioned Area	Exposed to Outdoors	Concealed Non-Conditioned Area	Concealed Conditioned Area
1 FIRE PROTECTION SYSTEM, EXPOSED TO FREEZING, 1/2" TO 8"					
Insulation Type	3	3	6	3	3
Thickness, inches	1.5	1.5	2	1.5	1.5
Application	P2	P2	P3	P2	P2
Finish	8	8	Paint	8	8
Fitting Type	1	1	3	2	2
Fitting Finish	7&1	7&1	None	7	7
2 DOMESTIC COLD WATER (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	2	1	1
Application	P2	P2	P2	P2	P2
Finish	8	8	8&3	8	8
Fitting Type	1	1	2	2	2
Fitting Finish	7&1	7&1	7&3	7	7
3 DOMESTIC HOT WATER, HOT WATER RETURN (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1.5	1.5	1.5	1.5	1.5
Application	P1	P1	P1	P1	P1
Finish	8	8	8&3	8	8
Fitting Type	1	1	2	2	2
Fitting Finish	7&1	7&1	3	7	7
4 COOLING COIL DRAINS, CONDENSATE DRAINS (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	1	1	1
Application	P2	P2	P2	P2	P2
Finish	8&3	8&3	8&3	8	8
Fitting Type	2or3	2or3	2or3	2or3	2or3
Fitting Finish	7&3	7&3	7&3	7	7
5 PLUMBING P-TRAPS RECEIVING CONDENSATE DISCHARGE (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	1	1	1
Application	P2	P2	P2	P2	P2
Finish	8&3	8&3	8&3	8	8
Fitting Type	2or3	2or3	2or3	2or3	2or3
Fitting Finish	7&3	7&3	7&3	7	7

	Exposed Non-Conditioned Area	Exposed Conditioned Area	Exposed to Outdoors	Concealed Non-Conditioned Area	Concealed Conditioned Area
6 STORM WATER DRAINAGE – SD – ROOF AND OVERFLOW SYSTEMS (Fiberglass, rigid)					
Insulation Type	3	3	3	3	3
Thickness, inches	1	1	1-1/2	1	1
Application	P2	P2	P2	P2	P2
Finish	8&3	8&3	8&3	8	8
Fitting Type	2or3	2or3	2or3	2or3	2or3
Fitting Finish	7&3	7&3	7&3	7	7
All piping shall be insulated and insulate the roof and overflow drain (RD) sumps with sheet insulation as scheduled. Horizontal piping within crawl-space need not be insulated.					
7 HOT WATER EXPANSION TANKS (Fiberglass, rigid)					
Insulation Type	3				
Thickness, inches	1.5				
Application	P1				
Finish	6&1				
Fitting Type	2or3				
Fitting Finish	6&1				

END OF SCHEDULE

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 231123 - GAS PIPING SYSTEM

PART 1. - GENERAL

1.01 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of equipment of this type whose products of this type have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with Work similar to that required for this project.

C. Install piping to meet requirements of the local ordinances.

D. Ascertain those materials meet or exceed minimum requirements as specified. Comply with manufacturer's installation recommendations.

E. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

F. Provide complete system and installation to conform with NFPA-54.

G. Contractor responsible for coordinating **exact equipment** BTU's compared to the contract documents, and contact the engineer with any discrepancies **before installation of piping** and verify route of pipe run maintains the perimeters of the pipe size for the CFH/BTU's indicated per the requirements of the IFGC.

1.02 SUBMITTAL

A. Submit product data on all manufactured items.

B. **Contractor must specifically identify on cover letter any deviations from the approved specifications.**

C. Submit Shop Drawings of anodeless and anode-protected risers.

PART 2. - PRODUCTS

2.01 GAS PIPING (Above ground, and interior)

A. Steel: Black steel, Schedule 40, ASTM A53, A120, or ANSI B36.10; 4" and smaller, malleable iron screwed fittings, 150 lbs., ANSI B16.4; 2-1/2" and larger, wrought steel butt welding fittings, ANSI B16.9.

B. Sleeving of interior gas piping me be omitted if the following requirements are met: 1. Fully welded steel piping by a certified welder.

1. Line sizes 1" and smaller to be socket welded.
2. Line sizes 1-1/4" and larger to be butt-welded.
   a.

2.02 GAS PIPING (Underground)

A. Plastic: Thermoplastic gas pressure pipe and fittings, SDR 11 polyethylene PE2306 Grade P23 Class C, with #14 stranded copper TW companion wire.

B. Factory Prebent, Coated Steel Risers, 2" and smaller.

1. Anodeless type risers.
2. Meet ASTM D2513 and DOT 192.283.
3. CSA approved and IAPMO listed.
4. Epoxy coated.
5. Schedule 40 steel casing or cold formed carbon steel ERW tubing.
6. Factory installed tracer wire.
7. Model: **Central Plastics Anodeless Service Risers**.

C. Factory Prebent, Coated Steel Risers, 2-1/2" and 3".

1. Anode protected.
2. Meet ASTM D2513 and DOT 192.283.
3. CSA approved and IAPMO listed.
4. Epoxy coated.
5. Schedule 40 steel casing.
6. Factory installed tracer wire and anode connection.
7. Protected by an anode.
8. Model: **Central Plastics Transition Service Risers**.

D. Joints: Fusion joints, according to manufacturer's instructions.

E. Manufacturers: **Nipak Polyethylene, Continental Mark II**, or **Phillips Marlex TR-418**.

F. Epoxy Resin: Reinforced epoxy resin gas pressure pipe fitting, Schedule 40, ASTM D2517, with #14 stranded copper TW companion wire

G. Steel, Protected: Galvanized steel, Schedule 40, ASTM A120; malleable iron screwed fittings, 150 lbs., ANSI B16.4; plastic extruded coating (Extrucoat) with hot-applied coal tar tape coating (Tapecoat 20) for fittings or hot-applied coal tar tape coating (Tapecoat 20) for pipe and fittings, Federal Specifications L-T-1512. Provide anodes to cathodically protect metallic pipe in ground.

H. Corrugated stainless steel tubing: “Gastite ©” ANSI/IAS LC-1. ICBO Evaluation Report ER-5122.

1. ASTM A240 type 304, 321 corrugated stainless steel tubing (THM 1042) with a min. wall thickness of .010. Jacketing to be TENITE polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density.
2. All mechanical tube fittings are to be SAE CA360 brass incorporating double wall flare for sealing and “Jacket Lock “ jacket capturing for steel tubing protection.

2.03 VENTING (Gas-fired appliances)

A. Metal: UL listed, double wall, type B or BW as required by appliance listing; UL listed anti down-draft raincap.

2.04 GAS PRESSURE REGULATORS

A. Provide adjustable, single staged, steel jacketed, corrosion resistant, elevation compensated, spring-loaded regulator with internal relief valve, screened vent, " npt gauge port with threaded pipe plug for high-pressure side test gauge, sized for indicated flow rate at specific gravity and appropriate pressure.

1. **Fisher S102**.
2. **Fisher S201**.

2.05 LABORATORY OUTLETS

A. Laboratory outlet with back mounted wall flange, **Chicago 986**, straight way needle valve with wheel handle and serrated nozzle, blue button handle index, with the letters "GAS" in white: **Chicago 937-WH-E7**.

2.06 GAS METERS

A. Make arrangements for obtaining gas service from local gas utility company with screwed connections of size indicated, for gas working pressure, specific gravity, and volume flow ranges as indicated.

B. Provide diaphragm type, positive displacement gas meter with aluminum case, temperature compensated, with internal corrosion resistant components, and screwed connections of size indicated, for gas working pressure, specific gravity, and volume flow ranges as indicated.

C. Obtain meter with pulsed output for EMCS monitoring.

PART 3. - EXECUTION

3.01 INSTALLATION

A. General: Install a complete system of piping for natural and manufactured gas in the vapor phase, from the point of delivery (outlet of the shut-off valve) to the connections with each building appliance.

B. Installation: Install fusion joints, according to manufacturer's instructions, by person instructed and qualified by piping manufacturer, regularly engaged for previous 2 months installing plastic gas pipe.

C. Install the gas supply system where indicated on Drawings, but generally exposed on outside walls, on the roof, concealed above vented ceiling, in vented crawl space, in vented pipe chases, in vented walls, and underground outside of building. Do not install gas supply system piping in or on the ground under any building or structure. Keep exposed piping minimum of 6" above grade or structure. Install products in accordance with manufacturer's instructions.

D. Piping System:

1. Cover: Install horizontal underground piping with not less than 12" (300 mm) of cover on private property and not less than 18" (450 mm) of cover in public right-of-way at street or alley.

2. Pitch: Down at not less than 3" per 100' (250 mm per 100m) in direction of main supply risers toward appliance connection to allow drainage of system.
3. Clearances: Maintain following minimum horizontal clearances between lines:
   a. Pipe 2" and smaller: 4"
   b. Pipe 2-1/2" and larger: 12"
   c. Other services: 12"
   d. Maintain a minimum 1" vertical clearance between lines crossing at an angle greater than 45E.
4. Provide a 3" minimum length of dirt pocket in piping at each appliance connection.
5. Underground Polyethylene Piping: Follow manufacturer's instructions.
   a. Do not pull tight and straight; allow to lie in loose serpentine along the ditch bottom.
   b. Install on undisturbed or well compacted soil which contains no rocks or sharp objects, with full length bearing on the ditch bottom; do not support by blocking; do not span any portion of the ditch bottom.
   c. Backfill with fine or granular material free of rocks or other sharp objects.
   d. Assure that soil beneath polyethylene pipe is well compacted at the point of its connection with steel pipe.
   e. Do not extend polyethylene pipe above ground or into or under any building or structure.
   f. Do not install polyethylene piping that has been crushed, kinked, split, or otherwise damaged.
   g. Service (Anodeless) Risers: Support by a steel post, driven or set into firm ground, or otherwise stabilized to prevent transferral of force due to natural settling or accidental movement of the riser to the polyethylene pipe.
   h. Install an electrically continuous 14 AWG TW insulated copper wire adjacent to the pipe in a manner to facilitate locating it with an electronic pipe locator. Connect one end of the wire to the riser or to the support post to facilitate connection of a pipe locator.
6. Keep the inside of piping dry and free of dirt, cutting burrs and other foreign substances. Ream ends of pipe smooth after cutting. Thread steel pipe with true, sharp dies to insure a proper joint make-up.
7. Carefully handle piping with applied covering to be installed underground. Examine the pipe covering for damage and repair before pipe is covered. Install underground piping in trench bed free of rocks and cover with overlaying backfill free of rocks that could damage covering.
8. Install manual ground gas cock at each equipment connection and at each entry into each building.
9. Use insulated couplings when dissimilar metals are joined and where metallic pipe leaves the ground.

E. Venting: Install combustion-venting system in accordance with its UL listing, in accordance with manufacturer's instructions, and in accordance with the Contract Document.

F. Gas Meter:

1. Install gas meter, a regulator and a meter-regulator loop in accordance with details furnished by the Gas Company and with details indicated on the Drawings.
2. Install gas meter, a regulator and a meter-regulator loop in accordance with details indicated on the drawings.

3.02 INSPECTION

A. Do not enclose or cover any work until it is in compliance with and has been inspected, tested, and accepted by the local building authority.

3.03 TESTING

A. Interior Piping: Test before equipment is connected with not less than fifty pounds per square inch in dry air. Test joints with a soap solution for leaks. After all leaks have been repaired, test the system with not less than 50 pounds per square inch dry air for a minimum of 24 hours with no loss in pressure.

B. Exterior Piping Below Grade: Test before building service connections are made with not less than 90 pounds per square inch dry air. Test joints with a soap solution for leaks. After all leaks have been repaired, retest the system with not less than 90 pounds per square inch dry air for a minimum of 24 hours with no loss in pressure.

C. Subject Gas piping to a pneumatic pressure test of 60 psi for 30 minutes.

D. While under pressure test, apply soapy water solution to all welded joints for the purpose of detecting leaks.

E. If leaks are found in welded lines, repair by chipping rewelding operations.

F. Repeat, alternating testing and welding operations until the gas piping systems are absolutely tight.

G. If leaks are found in threaded joints, repair by properly tightening or replacing fitting.

H. Repeat, alternating testing and repair operations until the gas piping systems are absolutely tight.

I. Final test entire gas piping system to a pneumatic pressure of 50 psi for a period of 24 hours and demonstrate that the piping system is absolutely tight.

J. Perform any additional tests as required by code, City or governing body.

K. Comply with Georgia HB 1611.

L. Complete gas certification forms and submit copies to owner, architect, & utility company. Railroad Commission of Georgia form PS-86 & PS-87.

END OF SECTION 231123

SECTION 232310 - FANS

PART 1. - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 QUALITY ASSURANCE:

A. Manufacturers: Provide products manufactured by one of the following for each type of fan:

1. Acme
2. Carnes
3. Cook
4. Greenheck
5. Penn
6. Stanley
7. Mars (Fly Fans)

B. Industry Standards:

1. Provide fans which bear Air Movement and Control Association (AMCA) certified performance rating seals.
2. Provide fan components which have been listed and labeled by Underwriters' Laboratories.
3. Comply with applicable portion of National Electrical Manufacturer's Association standards for motors.

1.03 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties on all items.

PART 2. - PRODUCTS

2.01 CEILING EXHAUST FANS:

A. Provide ceiling exhaust fans, in types and sizes indicated; locate where shown. Provide direct-driven fans with permanently lubricated, continuous duty, thermally protected, ball bearing motor. Construct fan housing of sheet steel with enamel finish, lined with sound absorbing acoustical insulation securely fastened to walls of housing. Provide a true centrifugal wheel with air outlet perpendicular to inlet and with statically and dynamically balanced wheel. Provide a white ceiling grille. Equip motor with integral thermal overload protection and with terminal box mounted on housing with cord, plug and receptacle inside housing.

2.02 WALL MOUNTED PROPELLER EXHAUST FANS:

A. Provide wall mounted propeller type fans of the size and type as shown on the drawings. Fan shall be direct driven, or belt driven as indicated with continuous duty motors resiliently mounted in a basket and guard meeting OSHA requirements. Propeller blades shall be statically and dynamically balanced. Fan panels shall have a deep spun steel venturi and

welded corners. Provide disconnect switch, motor side fan guard, gravity wall shutter, weather hood and mounting sleeve. Provide speed controllers for direct drive fans. Provide louvers sized to match fan size and fan airflow. Louvers shall conform to the requirements of section 232210.

2.03 ROOF MOUNTED CENTRIFUGAL EXHAUST FANS:

A. Provide roof mounted centrifugal fans of the size and type as scheduled on the drawings. Fans shall be constructed with watertight housing capable of resisting 100 MPH winds and shall be direct or belt-driven as indicated. Motor shall be in a compartment out of the air stream. Housings shall be minimum 16 gauge spun aluminum. Fan wheel shall be of aluminum, dynamically and statically balanced, non-overloading backward-curved blades mounted on steel shaft. Equip with self-aligning heavy-duty bearings designed for end thrust and lubricated for a minimum of 10 years usage at operating temperatures of -65 to 100 degrees F. Provide vibrationless lubricated ball bearing motor with integral thermal overload protection and electrical disconnect switch under ventilator cap. Provide bird screen, backdraft dampers, and matching roof curb.

2.04 IN-LINE CENTRIFUGAL FANS:

A. Provide an in-line centrifugal fan of the size and type as scheduled on the drawings. Fan housing shall be heavy-gauge painted steel. Fans shall be direct or belt-driven as indicated with aluminum centrifugal wheels with backwardly inclined, non-overloading blades. Inlets shall be deep spun for nonturbulent entrance. Provide a 100% gasketed panel to permit access to interior, and provide an internal terminal box mounted on the exterior. Provide disconnect switch, insulated housing, backdraft damper and hanger brackets with vibration isolators.

2.05 ROOF MOUNTED AIR INTAKES:

A. Roof mounted air intake shall be constructed of heavy gauge aluminum with hinged housing. Vertical seams shall be continuously welded with lock formed seams on hood ends. Hoods shall be stressed and sloped for drainage. Provide aluminum insect screen and matching roof curb.

2.06 FLY FANS:

A. Provide wall mounted fly fans over the interior of doors as shown on the drawings. Capacity shall be as scheduled on the drawings. Cabinet shall be manufactured of one-piece molded high density polycarbonate. Fan motor shall be continuous duty type with permanently lubricated sealed ball bearings, totally enclosed, resilient mounting and thermal overload protection. Provide adjustable intake louvers and adjustable air directional control vanes at outlet nozzle. Provide beige finish and micro switch for automatic on/off control.

2.07 KITCHEN HOOD EXHAUST FANS:

A. The exhaust fan shall be U.L. listed for grease duct use and shall be the upblast type of spun aluminum construction with belt-driven fan with backward-inclined or airfoil blades only, containing a built-in grease trough and having a completely isolated motor compartment and hinged frame. No birdscreens or backdraft dampers will be permitted per NFPA96. Furnish an 18 gauge galvanized curb, minimum 18 inches high, to raise fan discharge 40 inches above the roof surface. The fan shall be complete with disconnect switch.

2.08 KITCHEN HOOD SUPPLY FANS:

A. The supply fan shall be a forward curved, double-width, double-inlet blower mounted in a downblast position. The belt-driven fan shall be complete with permanently lubricated ball bearings, drives, belt, and motor with disconnect switch. The galvanized painted housing shall have four-sided intake, (4) 1 inch permanent cleanable filters, and a one-piece, weather-tight, removable top for easy access. Furnish an 18 gauge galvanized roof curb with duct adaptor and curb cap.

2.09 RESIDENTIAL RANGE HOODS:

A. Residential range hoods shall be the steel shell type with mitered sides and hemmed bottom suitable for mounting under a wall cabinet. Hoods shall be 30 inches wide and shall have a 75 watt light with safety lens, light switch, 190 cfm 2-speed fan with rocker switch, washable aluminum filter, polymeric fan blades, backdraft damper, 7 ” round duct connection. Hoods shall have stainless steel finish.

B. Each hood shall have a pre-engineered, pre-assembled, wet chemical automatic fire extinguisher unit consisting of an extinguisher kit, a piping kit, and a detection kit. All components shall be installed in the hood and wall cabinet. The extinguisher kit shall have a pressurized storage cylinder with chemical agent, pressure gauge, valve assembly, micro switch, cable adjuster, spring, and mounting bracket. The piping kit shall consist of rigid piping and flexible hose with two system appliance nozzles equipped with adjustable swivels and full cone spray pattern. The detection kit shall consist of cable, corner pulleys, and four reusable link detectors. Provide an alarm horn and necessary shutoff devices to automatically shut off all power to the range. Provide auxiliary contact for connection to fire alarm system. Installation shall be in accordance with the manufacturer’s instructions.

PART 3. - EXECUTION

3.01 INSTALLATION OF FANS:

A. General: Except as otherwise shown or specified, install fans in accordance with manufacturer's written instructions and in accordance with National Electrical Code (NEC) and recognized industry practices.

B. The mounting height of each wall mounted thermostat or temperature sensor shall comply with ADA for maximum side reach. The top of the thermostat or sensor shall be at 54” above the floor.

3.02 TESTING:

A. After installation of fans has been completed, test each unit to demonstrate proper operation at performance requirements specified, including, but not limited to, proper rotation of impeller. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

END OF SECTION 232310

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 233000 - AIR SUPPLY AND DISTRIBUTION

PART 1. - GENERAL

1.01 DESCRIPTION OF THE WORK

A. **As additional items Mechanical Sub-Contractor shall include in his Base Proposal the following:**

1. **All costs to provide 12 additional Fire Dampers (18" x 16") at each campus, all required sleeves, access doors and sealant as directed by Architect-Engineer.**

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of air conditioning products of this type whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with air conditioning work similar to that required for this project.

C. NFPA Compliance: Comply with the requirements and recommendations of NFPA 90A.

D. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

E. Comply with requirements and recommendations of local codes and ordinances.

F. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

G. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing "as installed" work.
3. In addition to the above, the Contractor shall accumulate during the Job's progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:

a. All warranties, guarantees and manufacturer's direction on equipment and material covered by the Contract.
b. Approved fixture/equipment brochures
c. Copies of approved Shop Drawings
d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
e. Any and all data and/or plans required during construction.
f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
g. The first page or pages shall have the name, addresses and telephone numbers of the following; General Contractor and all sub-contractors, Major Equipment Suppliers.

H. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

I. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

J. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.03 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit the following product data, shop drawings, samples, and manufacturer's certifications:

Item	Product Data	Shop Drawings	Samples
Ductwork	X	X	
Duct liner	X		
Ductwork, metal	X	X	
Flexible round ducts	X		
Duct taps	X		
Duct Wrap	X		
Other Products	X		

C. Submit reports and other documents as required.

D. Submit static pressure calculations based on actual equipment proposed and based on above ductwork shop drawings.

PART 2. - PRODUCTS

2.01 DUCTWORK, GENERAL (Heating, Ventilating, and Air Conditioning)

A. General: Provide materials that have been tested and listed by UL as Class 1 Air Duct and are labeled in accordance with UL Standard for Air Ducts, UL 181.

B. Construct in accordance with SMACNA "HVAC Duct Construction Standards, Metal and Flexible", latest edition.

C. Dimensions indicated on Drawings are inside, clear dimensions unless stated otherwise.

2.02 SUPPLY DUCTWORK

A. Rectangular, Class 2 (Static pressure below 2" wg, positive or negative, velocity up to 2,000 fpm):

1. From air supply units:
   a. Lined sheetmetal.

B. Round Connections to Diffusers: Round Sheetmetal, Insulated.

1. Duct: Galvanized longitudinal lock-seam round or oval as indicated on Drawings, fabricated in conformance with SMACNA Duct Construction Standards, suitable for two (2") positive duct static working pressure.
2. Insulation: Duct Wrap.

C. Round Connections to Diffusers: Flexible, Insulated.

1. Core: Round, flexible multi-ply wall, glass fiber reinforced.
2. Integral seamless air seal.
3. Zinc-coated high carbon spring steel bonded to core.
4. Insulation: 2" thick 3 pcf density fiber glass insulation, minimum R-Value = 8.0.
5. Aluminum, fiber glass reinforced, kraft laminate, 0.02 perm rating (ASTM E97-53T), non-toxic, non-delaminating, non-corrosive.
6. Draw Bands: Use one of the following.
   a. 403 stainless steel, .020" x .3125" by length required, non-corrosive, fire proof, manufacturer's recommended application tool; **Dyn-O-Tie**.
   b. Nylon 66, suitable for maintaining UL listing of related duct, length required, non-corrosive, self-extinguishing, lock with quick release, manufacturer's recommended application tool; **Dyn-O-Tie**.
   c. Galvanized steel, d" x .015", with nylon worm screw tightener; **Young Quick-Clamp**.
7. Maximum five foot (5') lengths.
8. **Atco UPC #036; minimum R-Value = 6.0.**

2.03 RETURN DUCTWORK AND CONNECTION TO GRILLES

A. Rectangular, Class 2 (Static pressure below 2" wg, positive or negative, velocity up to 2,000 fpm):

1. To air supply units:
   a. Lined sheetmetal.
   b. Flex is not approved as return duct.

2.04 OTHER DUCTWORK

A. Outside Air:

1. Rectangular: Lined sheetmetal.
2. Round: Insulated sheetmetal.

B. Exhaust, General:

1. ***Locker Room Areas, Shower Areas, Drying Areas*** and other wet or water vapor carrying Exhaust: Unlined **ALUMINUM** sheetmetal with joints sealed.
2. Other Exhaust Ductwork, First 20' From Exhaust Fan:
   Lined sheetmetal.
3. All Other Exhaust Ductwork, First 20' From Exhaust Fan: Lined sheetmetal.
4. Flex is not approved as exhaust duct.

2.05 ERV DUCTWORK, ALL ASSOCIATED DUCTWORK:

A. Rectangular: Lined sheetmetal.

B. Round: Insulated sheetmetal. Galvanized longitudinal lock-seam round or oval as indicated on Drawings, fabricated in conformance with SMACNA Duct Construction Standards, suitable for two (2") positive duct static working pressure.

C. Flex is not approved as ERV duct.

2.06 DECORATIVE ROUND, EXPOSED IN CONDITIONED SPACE:

A. Supply Duct: Spiral sheetmetal, RL-1 spiral (flat inside) or RL-5 spiral (flat outside) seam, 2" internal insulation minimum R-Value – 8.0, perforated steel inner liner; **United Acousti-k27, Type K or P**.

B. Return Duct, Exhaust Duct: Spiral sheetmetal, RL-1 spiral (flat inside) or RL-5 spiral (flat outside) seam, 2" internal insulation minimum R-Value – 8.0, perforated aluminum inner liner; **United Acousti-k27, Type K or P**.

C. Fittings: Stamped two-piece, welded seam, aluminum, insulation and liner as for duct.

1. Joints: RT-3 draw-band with hanger straps at joints, bolts at top, or RT-1 beaded sleeve joint with RT-3 draw-band at hangers, aluminum, insulation and liner as for duct.
2. Branches: Cone-tee, with blade damper in take-off branch; do not use saddles.
3. Hanger Straps: Same material as duct, of straight sheet, minimum 2" wide.
4. Design: SMACNA HVAC Duct Construction Standards, Chapter 3.
5. Provide round or flat-oval as indicated elsewhere.
6. Paint grip surface, cleaned and prepped for priming & painting.

2.07 DUCTWORK ACCESSORIES

A. Turning Vanes: SMACNA Fig. 2-3, double-thickness, type 1 runner, bolted, screwed, or welded in place, every sixth vane screwed in place.

B. Flexible Duct Connections: Fibrous glass fabric, six to ten inches wide, coated with inorganic elastomeric compound suitable for installation in locations as indicated. The composite system shall comply with UL 214 and be classified as "flame-retarded fabrics" in Part II, UL Building Materials Directory. Insulate Connector with Duct Wrap Insulation, extend insulation a minimum of 3” beyond connector on both sides or butt to unit.

C. Air Extractors: Tuttle and Bailey Vectrol parallel curved blade, adjustable.

1. VLR or AVLR where accessible from face of register.
2. VLC with Young No 1 operator, No 666 - d" end bearings, and d" square shaft for other locations. Set operator on face of duct where duct is accessible, on soffitt of ceiling elsewhere.

D. Round Taps: Genflex cone spin-in fitting with scoop and damper; SM-2DEL for sheet metal.

E. Fire Dampers: Air Balance Inc. model 118, 119, or 319; 1-1/2 hour fire protection ratings UL listed for compliance with NFPA 252, UL classified 165E F fusible link. Provide collars, mountings, and fasteners between fire damper and wall in accordance with UL listing.

F. Fire Damper Access Doors: Provide Air Balance Inc. Fire/Seal duct and enclosure access door for each fire damper.

G. Branch Duct Volume Dampers:

1. Accessible from face of grill: Tuttle and Bailey No. 8 or A8, opposed-blade multi-louvered damper, blades in vertical position, galvanized or painted steel or aluminum, key or screwdriver operated from the face of the grill.
2. Not accessible from face of grill: Tuttle and Bailey No. 7S, opposed-blade multi-louvered damper, blades in vertical position, galvanized or painted steel or aluminum, worm drive adjuster with operator external to the duct.

H. Outside Air and Control Dampers: Low-leakage opposed blade dampers with edge and jamb seals leaking less than one percent against a pressure of 4" wc.

2.08 DUCT LINER

A. Duct Liner Materials:

1. Provide product that meets ASTM C 1071, Type I Flexible, ASTM G 21 and G22. ICC compliant NAIMA fibrous glass duct liner installation standard, NFPA 90A and 90B. and II.
2. Provide factory applied edge coating, Microban treated.
3. Flame spread of less than 25 and smoke developed of less than 50 when tested by UL723 test method, "k" of less than 0.254 when tested by ASTM C518-70 test method.
4. Will not cause or accelerate corrosion of aluminum, copper, or steel when tested by the Federal Specification HH-I-558B test method.
5. Mark continuously on airstream side of the material with:
   a. Insulation thickness.
   b. Name of manufacturer.
   c. Type.
   d. NFPA 90A.
6. **Johns Manville Duct Liner, Linacoustic RC, minimum R-Value = 6.3,** 1-1/2 inch thickness.

B. Duct Wrap Insulation: (for sheetmetal portion of diffuser runouts only and flexible connections)

1. Provide product that meets ASTM C 553-92, Type I & Type II, ASTM E 84.
2. Provide factory applied edge coating, Microban treated.
3. Flame spread of less than 25 and smoke developed of less than 50 when tested by UL723 test method, "k" of less than 0.24 when tested by ASTM C518-70 test method.
4. Will not cause or accelerate corrosion of aluminum, copper, or steel when tested by the Federal Specification HH-I-558B test method.
5. Mark continuously on side of the material with:
   a. Insulation thickness.
   b. Name of manufacturer.
   c. Type.
   d. NFPA 90A.
6. **Johns Manville Duct Wrap FSK (Aluminum face), Type 150, minimum R-Value = 6.0**, 1-1/2 inch thickness.

C. Outside Ductwork Exposed to Weather or Where Required by Ordinance: 1-1/2" thick internal duct liner.

D. Other Ductwork Indicated to be Lined: 1-1/2" thick internal duct liner.

E. Adhesives: Conform to Adhesive and Sealant Council Standards for Adhesives for Duct Liner, ASC-A-7001C.

F. Mechanical Fasteners: Conform to Mechanical Fastener Standard MF-1of SMACNA Publications.

2.09 DUCT AND DUCT INSULATION SEALANTS

A. Non-flammable, fast-setting, rubber-based, UL classified, high velocity duct sealer; **Design Polymerics DP-1010**.

2.10 ROOFTOP GRAVITY INTAKE AND EXHAUST HOODS

A. Provide factory fabricated aluminum or galvanized steel hoods, set on factory fabricated roof curb with lock-formed seams on the hood, continuously welded seams on the vertical joints of the air shaft, and incorporating the following features:

1. Motorized back-draft damper.
2. Insect screen installed horizontally over the throat.
3. Throwaway filter of non-hygroscopic media and non-cardboard frames, 1" or 2" thick.
4. Aluma-Glas protection on both sides of metallic parts, 30 mil thick.
5. Where size is indicated on the Drawings as square feet (SF), provide unit with throat square footage and inlet net free area of that amount.
6. Minimum curb height: 12" at low point of roof, 8" at high point of roof, or as elsewhere scheduled.

2.11 INTAKE-EXHAUST SCREENS

A. Insect Screen: Aluminum mesh, 8/inch.

PART 3. - EXECUTION

3.01 DUCTWORK

A. Install in accordance with SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

B. Duct dimensions on Drawings, unless otherwise indicated, are inside, clear dimensions.

C. Fire Dampers: Provide collars, mountings, and fasteners between fire damper and wall and install in accordance with UL listing. Follow installation details given in SMACNA Fire Damper Guide for Air Handling Systems, except make all sleeves not lighter than 14-gage (0.0781 inch). Provide retaining angles, sleeves, breakaway connections and other items associated with the fire dampers. Whenever possible, size fire dampers to obtain the clear opening of the adjacent ductwork.

D. Duct Access Doors: Set in duct for inspection and for easiest access to fire dampers, automatic dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Follow installation details given in SMACNA Low Velocity Duct Construction Standards. Make access doors minimum of 15" x 18" unless duct will not accommodate this size. Provide ceiling and wall access doors if the duct access door is not otherwise accessible.

E. Sheetmetal Duct Joints: Coat duct joints, taps, and other similar sheetmetal abutments with duct sealant in a manner to prevent overall system leakage in excess of 5% or spot leakage that is detectable by sense of touch or hearing.

F. Exposed Spiral Round Ductwork:

1. Provide ductwork that is suitable for painting for decorator purposes.
2. Maintain finish of duct and hangers in unblemished condition; clean as specified in Section: BASIC MATERIALS AND METHODS, MECHANICAL.
3. If visible surface is dented, bent, or scratched, remove it and replace with new piece.
4. Complete the installation in accordance with SMACNA HVAC Duct Construction Standards and the recommendations of the duct manufacturer.

G. Round Flexible Duct:

1. Install without kinks and bends.
2. Install in straight runs, only slightly offsetting to accommodate alignment of the two joined pieces.
3. Secure the round flex to straight, metal round using draw bands.

3.02 FLEXIBLE DUCT CONNECTIONS

A. Make duct connections to fan-powered units, including AHU, Room FCU, RTU, VAV, and other unit's discharge and inlet with flexible duct connection. For round ducts, secure the flexible material by zinc-coated steel clinch-type draw bands or if indicated on the Drawings, connect with round flexible duct. For rectangular ducts, lock to metal collars using normal duct construction methods. Install with folds in material; do not stretch it.

3.03 DUCT LINER

A. General: Completely cover all portions of duct designated to receive duct liner. Butt transverse joints neatly together without interruptions, gaps, or overlaps.

B. Facing: Face black coated surface of liner to the air stream.

C. Adhesive: Adhere duct liner to the sheet metal with 100% coverage of adhesive. Coat exposed leading edges and transverse joints with adhesive. Additionally, secure the duct liner to the sheet metal with mechanical fasteners, compressing the liner sufficiently to hold it firmly in place.

D. Cutting: Cut duct liner to assure overlapped and compressed longitudinal corner joints.

E. Fastener Spacing, for Velocities From 0' to 2000' Per Minute: Start within 3" of the upstream transverse ends of the duct liner and 3" of the longitudinal joints and space fasteners 12" on center around the perimeter of the duct, except, the fasteners may be a maximum of 12" from corner break. Elsewhere, space fasteners a maximum of 18" on center, except place the fasteners no more than 6" from a longitudinal joint nor more than 12" from a corner break.

3.04 ROUND SHEETMETAL DUCT WRAP INSULATION

A. Wrap flexible fiberglass insulation around ducts and secure with outward clinching staples. Ducts 24" wide and larger additionally secure with stick cups on 18" centers or with 4" wide bands of adhesive applied on 18" centers. Lap insulation a minimum of 4" and seal all seams and penetrations with an approved mastic reinforced with 3" glass mesh reinforcement. Seal all raw glass to duct where insulation terminates.

3.05 FLEXIBLE INSULATED DUCT CONNECTION TO DIFFUSERS

A. Lap insulation a minimum of 4" and seal all seams and penetrations with an approved mastic reinforced with 3" glass mesh reinforcement. Seal all raw glass to duct where insulation terminates.

3.06 FLEXIBLE INSULATED DUCT CONNECTION TO ROUND SHEETMETAL

A. Lap insulation a minimum of 4" and seal all seams and penetrations with an approved mastic reinforced with 3" glass mesh reinforcement. Seal all raw glass to duct where insulation terminates.

3.07 DUCT JOINT SEALING

A. Seal longitudinal and transverse joints in sheet metal ductwork with sealant.

3.08 FAN POWERED UNITS

A. Hangers: Suspend units from rubber-in-shear isolators.

B. Duct Connections: Provide flexible duct connections as specified above.

3.09 LABORATORY FUME HOOD EXHAUST SYSTEMS (For removal of nonflammable corrosive fumes and vapors)

A. Install complete exhaust system to comply with the requirements and recommendations of NFPA 91.

B. Provide hangers, supports, fire protection, fire dampers, duct access, and other components.

3.10 TEMPORARY FILTERS

A. In units indicated elsewhere to have filters, install temporary throw-away filters in them before operating their fans. Keep them in place until final test and balance. Then install the specified filters.

B. Provide (3) three complete sets of filters for the project.

1. Set one, initial set during construction.
2. Set two, new filters for Testing Adjust & Balance.
3. Set three, prior to owner move in, after TAB.

3.11 TEST AND BALANCE

A. Test, adjust, and balance equipment, air terminals, and all other devices for indicated capacities. See also Section: TEST-ADJUST-BALANCE.

B. Duct Leakage:

1. HVAC Ductwork: Test for leakage by applying 4.5" static pressure or 1.5 times the working pressure.
2. Correct leakage that is detected by listening or feeling, and retest.

END OF SECTION 233000

SECTION 233713 - GRILLES, REGISTERS, AND DIFFUSERS

PART 1. - GENERAL

1.01 RELATED DOCUMENTS

A. Related documents are as follows:

1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. General Requirements and General Requirements, HVAC.
3. Basic Materials and Methods, HVAC.
4. Other sections of the specifications as applicable.

1.02 QUALITY ASSURANCE

A. Performance Tests: Provide only devices that have been tested and cataloged in accordance with ADC 1062-R4 and ASHRAE Standard 36-72.

B. Acceptable Manufacturers:

1. Titus
2. Krueger
3. Tuttle & Bailey
4. Anemostat
5. MetalAire
6. Price

1.03 SUBMITTAL

A. Submit Product Data on all grilles, registers, and diffusers, and on all their accessories; include materials, finishes, and performance data.

B. Indicate performance data. Relate performance data to the indicated air quantities and throw dimensions.

PART 2. - PRODUCTS

2.01 GRILLES, REGISTERS, AND DIFFUSERS

A. General:

1. Size units for the indicated air quantities and throw dimensions.
2. Miter and rigidly support flange corners for a hairline crack.
3. Provide face bars adequate to resist bending or twisting, fitting tightly and closely within the framework.
4. Provide the units with a neck to slip inside ductwork for an airtight, noiseless connection.
5. Set units with face bars running the short dimension of the unit or vertical.
6. Screws: If units are secured in place with screws, provide factory counter-sunk screw holes and factory-furnished screws that match the finish of the unit.

B. Frames: Check the architectural drawings to supply the proper air diffusers and adapting framework for the type of construction at each outlet. Provide a frame of the same finish as the unit and of a configuration the manufacturer recommends for the construction involved.

C. Performance: Verify sizes against cfm requirements for each device to get room terminal velocity of 50 FPM without objectionable noise when the device is applied to the system. Coordinate any approved differences from the Drawings.

D. Filters: Return grilles MUST house and maintain in place, owner indicated standard size filters:

1. 24”x24” panel size
   a. 20”x20”x1” thk. Nominal, Industry Standard Size.
2. 24”x12” panel size
   a. 20”x10”x1” thk. Nominal, Industry Standard Size.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install units according to manufacturer's recommendations, securely, true and plumb, with screws in all screw holes.

B. Do not secure units with screws that are not factory-furnished as specified above with screws and screw holes.

C. Paint units located in acoustical tile ceilings and other surfaces with a factory finish off-white over a rust-proofing primer. Cover anodized units with a thick coat of plating for a complete dense coat.

D. Insulation:

1. Install supply air units in a manner to prevent condensation, either on their face or back-side (concealed side).
2. Apply insulation with sealed vapor barrier to the tops of diffusers that are connected to insulated or lined duct systems, or as otherwise scheduled, of thickness adequate to prevent condensation.
3. Apply insulation with sealed vapor barrier to the necks and backsides of supply air grilles and registers if condensation occurs.

END OF SECTION 233713

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 23 4133 - AIR PURIFICATION SYSTEM

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.02 REFERENCED CODES & STANDARDS

A. The following codes and standards are referenced throughout. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867

1.03 RELATED WORK

A. Testing, Adjusting and Balancing

B. Facility Access and Protection

C. Ductwork

D. Filters

E. Electrical Wiring

F. Control Wiring

1.04 QUALITY ASSURANCE

A. The Air Purification System shall be a product of an established manufacturer in the USA. The manufacturer shall have been in continuous operation for a period of 5 years.

B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

C. Technologies that do not address gas disassociation such as UV lights, powered particulate filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable.

D. Projects designed using ASHRAE Standard 62.1 *IAQ Procedure* shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled. The manufacturer shall provide independent test data on a previous installation in a similar application that proves compliance to ASHRAE 62.1 and the accuracy of the calculations.

1.05 SUBMITTALS

A. Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating model number and quantity of each type required for each unit/application.
2. Submittal sheet for each type of plasma generator and accessories furnished; indicating construction, dimensions, electrical data, and mounting details.
3. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled (when projects are designed with reduced outside air).
4. Product drawings detailing all physical, electrical and control requirements.

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts list.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of products shall be in factory fabricated shipping cartons. Identify on outside of carton the type of product contained within. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.07 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after shipment or eighteen months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

PART 2. - PRODUCTS

2.01 GENERAL

A. Approved manufacturers:

1. Plasma-Air
2. Global Plasma Solutions

B. All other suppliers of comparable products requesting prior approval shall:

1. Submit a request for prior approval at least 15 days prior to bid date. Request received after that time will not be considered.
2. In addition, as part of the prior approval request, Bipolar Ionization manufacturers must submit their IAQ calculations that prove conformance to ASHRAE Standard 62.1-2007 with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application shall also be included. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

2.02 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator with bipolar ionization output as described here within.

B. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
3. Reducing space static charges.
4. Reducing space particle counts.

C. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.

1. Airflow rates may vary through the full operating range of a VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have a maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions to the air purification system.

E. Ionization Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):
   a. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. Bipolar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time and corrosion.
   b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
   c. Ionization output from each electrode shall be a minimum of 5 million ions/cc when tested at 2” from the ion generator.
   d. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles or carbon fiber brushes protruding into the air steam will not be accepted.
2. Duct mounted units
   a. Where so indicated on the plans and/or schedules, plasma ion generators shall be supplied and installed by the mechanical contractor. The contractor shall follow all manufacturer IOM instructions during installation.
   b. Ion generators shall be furnished with a factory-equipped gasketed mounting flange to prevent air leakage. Gasketed flange shall be a minimum of 1 1/8" wide around the perimeter of the ionizer to insure no leakage occurs.
   c. Ion generators shall be field installed in a location that is convenient for visual inspection, removal, and servicing. They shall include an ion indicator light clearly visible from below the installed location.
3. Certifications
   a. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners.

b. The operation of the electrodes or bipolar ionization units shall conform to UL 867 with respect to ozone generation.

F. Electrical Requirements:

1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the fan coil unit or air handling unit served. Ion generators requiring a loose 120V or 230V transformer or power supply will not be accepted.
2. 24V AC will be supplied from the fan coil unit or heat pump control transformer. Mechanical contractor shall coordinate with that supplier to be sure an adequate transformer size is provided.
3. Wiring, conduit and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.

G. Control Requirements:

1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
2. All plasma ion generators shall include an external BMS interface to indicate ion generator status and alarm.

PART 3. - EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.02 ASSEMBLY & INSTALLATION: PLASMA GENERATOR WITH BI-POLAR IONIZATION

A. All equipment shall be assembled and installed with a high level of workmanship to the satisfaction of the owner, architect and engineer.

B. Any material damaged by handling, water or moisture shall be replaced by the mechanical contractor at no cost to the owner.

C. All equipment shall be protected from damage on a daily basis throughout construction.

3.03 COMMISSIONING & TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

B. Provide to the owner a portable hand held ion counter with a calibrated range of 0 to 20,000 ions/cm3 and an accuracy of +/- 25% within the specified range. Ion counter shall have automatic zeroing capability on 10 minute intervals.

END OF SECTION 234133

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 237400 - ROOFTOP PACKAGED HEATING/COOLING UNITS

PART 1. - GENERAL

1.01 RELATED DOCUMENTS

A. Related documents are as follows:

1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. General Requirements and General Requirements, Mechanical.
3. Basic Materials and Methods, Mechanical.
4. Other sections of the specifications as applicable.

1.02 QUALITY ASSURANCE

A. Approved manufacturers:

1. The following manufacturers are acceptable.
   a. **Carrier**
   b. **AAON**
   c. **Daikin**
   d. **Trane**

B. Installer: Qualified with at least 5 years of successful installation experience on projects with air conditioning work similar to that required for this project.

C. Comply with requirements and recommendations of SMACNA standards, NFPA 90A, other local codes and ordinances.

D. NEC Compliance: Comply with the National Electric Code, NFPA 70-1987, as applicable to wiring and other electrical construction of the unit. Conform to ARI Standard 210 or 365 "Performance Test" in cataloging of electrical data. List unit's electrical data for test conditions of 80°FDB, 67°FWB, 450 cfm/ton on evaporator, 115°F ambient air on condenser, 10% over- and under-voltage.

E. UL Compliance: Provide components with UL listing and labeling when there is an applicable UL category.

F. AGA Compliance: Provide unit with total design certified as in compliance with American Gas Association National Safety Standards.

1.03 WARRANTY

A. Complete 1-year parts and labor warranty on all equipment.

B. Additional 4-year warranty provided for the compressors.

C. Additional 14-year warranty provided for the heat exchangers.

1.04 SUBMITTAL

A. Submit list of all products incorporated into the Work.

B. Submit manufacturer's technical product data including capacity ratings and electrical ratings.

C. Submit manufacturer's drawings indicating dimensions and weight loadings, showing layout, mountings and supports, spatial relationship to associated equipment and nearby barriers, and connection location for condensate, air supply and return, electrical and controls.

D. Submit the following product data, shop drawings, samples, and manufacturer's certifications:

Product Item	Shop Data	Samples Drawings
Heating section		X
Air handling section	X	
Condensing section	X	
Refrigerant accessories	X	
Controls	X	
Other equipment		X

E. Submit reports and other documents as required.

PART 2. - PRODUCTS

2.01 GENERAL

A. DESCRIPTION OF WORK

1. The work contemplated under this section of the specifications includes the furnishing of all labor and materials necessary for the complete installation of wiring in conduit for lighting and power, etc., as hereinafter specified and as shown on the Drawings.

B. GENERAL UNIT DESCRIPTION

1. Unit(s) furnished and installed shall be packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standards. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.
2. Unit(s) shall be 100% factory run tested and fully charged with R-410A.
3. Units shall be convertible airflow design as manufactured.

2.02 UNIT CASING

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours.
2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Rigid urethane foam
   a. Thickness: 2 inch (50 mm)
   b. Meets UL94HF-1 flame requirements.
   c. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.

C. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvannealed steel.

D. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

E. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

F. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

G. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch. Electric heater shall have single point power.

H. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

I. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

J. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Lead condenser fan shall have EC motor to maintain condenser pressure at part load conditions. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be inverter hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

K. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

1. Global alarm condition (active when there is at least one alarm)
2. Supply Air Proving alarm
3. Dirty Filter Alarm
4. Compressor Trip alarm
5. Compressor Locked Out alarm
6. Supply Air Temperature Low Limit alarm
    a. Sensor #1 Out of Range (outside air temperature)
    b. Sensor #2 Out of Range (supply air temperature)
    c. Sensor #3 Out of Range (cold coil leaving air temperature)

L. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

M. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.

N. Motorized Recirculating Air Damper designed to permit 100% recirculation of exhaust air shall be factory installed.

O. Hail Guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.

2.03 AIR FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 and MERV 13 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

2.04 FANS AND MOTORS

A. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.

D. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

E. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently

lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

2.05 UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be

F. Economizer control shall be temperature.

G. Dirty filter sensor shall be factory installed.

H. Operating protocol: The DDC shall be factory-programmed for BACNetMSTP.

I. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.06 ROOF CURB

A. Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

B. Provide mechanical hold down of unit in accordance with unit manufacturers recommendations for fastening.

C. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

2.07 OPTIONS

A. Factory installed condenser coil hail guard assembly:

1. Shall protect against damage from hail.
2. Shall be of louvered style.

B. Provide one-piece unit top.

C. Factory installed condensate overflow switch.

D. Provide with factory installed, weather-proof, unpowered GFCI convenience outlet for wiring by electrical contractor.

E. Stainless Steel drain pan.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Extend drain piping of the size at the pan outlet to the nearest floor drain or as indicated on the drawings.

B. Do not fasten piping, conduit or similar items to any removable panel on a unit.

C. Install equipment and associated piping and other connections in a manner to prevent conduction of sound to the framing and structural elements of the building.

D. Provide structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

E. Provide charge of refrigerant and oil.

3.02 START-UP AND TESTING

A. Supply initial charge of refrigerant and oil.

B. Contractor to provide start-up of units, using included start-up form, and provide completed start-up form, in a tabbed section labeled “Start-Up Forms” in the O&M Manual.

C. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

D. Adjust unit for correct operation.

E. Test and adjust unit for scheduled capacities. See also Section: TEST-ADJUST-BALANCE.

END OF SECTION 23740

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 238310 – ENERGY MANAGEMENT CONTROLS SYSTEM

PART 1. - GENERAL

1.01 OVERVIEW

A. This document contains the specification and input/output summaries for a Building Automation System (BAS) for:

B. The system shall provide the Direct Digital Control (DDC), Energy Management and Building Automation System (BAS) for the air conditioning, heating and ventilating systems and shall interface with other microprocessor-based building subsystems as detailed in the Input/Output Summaries and as specified herein. All damper and valve actuators shall be electronic.

1.02 INSTRUCTIONS TO BIDDERS

A. The system specified in this document shall be native BACnet architecture providing full operator access via the Internet or Local Area Network utilizing only a browser for full operator access and control in through a thin-client architecture. The system shall be the **Automated Logic WebCTRL system furnished and installed by Automated Logic Georgia.** The requirements are described in this specification. No deviations from this specification are acceptable.

1.03 SCOPE OF WORK

A. Contractor's Responsibilities

1. The Contractor shall furnish and install all necessary software and hardware, wiring, and computing equipment in compliance with this specification. Any variances from this specification or related documentation shall be submitted in writing at the time of bid.

B. Acceptable Manufacturers

1. Provide equal performing controls systems as manufactured by the following:
   a. Johnson Controls
   b. Carrier

C. System Requirements

1. Standard Material/Products. All material and equipment used shall be standard components, regularly manufactured and available, and not custom designed especially for this project.
2. Modular Design. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.
3. Performance. The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

D. Equipment

1. System Hardware
   a. The Contractor shall provide the following:
      (1) PC’s, server(s), routers, modems and control modules as specified.
      (2) All sensing devices, relays, switches, indicating devices, and transducers required to perform the functions as listed in the sequence of operations.

(3) All monitoring and control wiring.

2. System Software
   a. The Controls Contractor shall provide all software identified in Part 2 of this specification, including the BAS Server, fully configured database, graphics, reports, alarm/events. The Graphical User Interface (GUI) shall be completely Web based as specified herein.

E. Codes and Regulations

1. Standards Authority. All electrical equipment and material, and its installation, shall conform to the current requirements of the following authorities:
   a. Occupational Safety and Health Act (OSHA)
   b. National Electric Code (NEC)
   c. National Fire Code
   d. Uniform Mechanical Code
   e. Uniform Building Code
   f. Uniform Plumbing Code
2. Product Applicable Standards. All distributed, standalone and unitary controllers supplied shall be in compliance with the following listings and standards:
   a. UL916 for Open Energy Management (for U.S. and Canada)
   b. FCC Part 15, Sub-Part B, Class A
   c. CE Electro Magnetic Compatibility
3. Manufacturer's Quality System. The control system manufacturer shall be ISO9001 listed for design and manufacture of environmental control systems for precise control and comfort, indoor air quality, HVAC plant operation, energy savings and preventative maintenance. ISO Certification shall be by a registrar that is accredited by an internationally recognized organization such as RAB. Copy of ISO9001 certificate shall be submitted with bid.
4. Conflict of Codes. Where two or more codes conflict, the most restrictive shall apply. Nothing in this specification or related documentation shall be construed to permit work not conforming to applicable codes.

1.04 GENERAL CONDITIONS

A. Changes in Scope of Work

1. Any changes in the scope of work must be authorized by a written Change Order.

B. Correction of Work

1. Contractor's Responsibility. The Contractor shall promptly correct all work found defective or failing to conform to the Contract Documents. The Contractor shall bear all cost of correcting such work.
2. During Warranty. If, within the warranty period required by the Contract Documents, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice to do so.

C. Coordination of Work During Construction

1. The Contractor shall coordinate any necessary changes in work scheduling to minimize disruption.
   a. The Contractor shall protect the installed works by other trades.
   b. The Contractor shall coordinate with other trades.
   c. The Contractor shall repair any damage caused by his work to building(s) and equipment at no additional cost to the owner.

D. Warranty

1. The Contractor shall warrant, from the date of final acceptance**,** that all systems, subsystems, component parts, and software are fully free from defective design, materials, and workmanship for a period of one year or longer as indicated in this specification.

1.05 SUBMITTALS, DOCUMENTATION, ACCEPTANCE AND TRAINING

A. Submittals

1. Shop Drawings. A minimum of four (4) copies of shop drawings shall be submitted and shall consist of a complete list of equipment, materials, manufacturer's technical literature, cut-sheets, and installation instructions. Drawings shall contain proposed layout, complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, installation details, and any other details required to demonstrate that the system will function properly.
2. Graphical Programming Documentation: The Contractor shall provide a printout all Graphical Programs, identifying the specific HVAC or mechanical/electrical subsystem being controlled
3. Drawing Approval. Shop drawings shall be approved before any equipment is installed. Controls contractor shall allow a minimum of fourteen (14) days for drawing approval.
4. As Built Drawings. All drawings shall be reviewed after the final system checkout and updated or corrected to provide 'as-built' drawings to show exact installation. All shop drawings will be acknowledged in writing before installation is started and again after the final checkout of the system. The system will not be considered complete until the 'as-built' drawings have received their final approval. The Contractor shall deliver **6** sets of 'as-built' drawings.

B. Documentation

1. Operating and Maintenance (O&M) manuals for the system shall be made available electronically using Acrobat (PDF) format and include the following categories: Workstation User's Manual, Project Engineering Handbook, Software Documentation.
   a. BAS User's Manual shall contain as a minimum:
      (1) System overview
      (2) Networking concepts
      (3) Launching a web browser from a networked PC/PDA and login
      (4) Graphical User Interface (GUI) screen menus and their definitions
      (5) Creating, modifying or deleting schedules
      (6) Uploading and downloading software to the field hardware
      (7) Creating historical trends, collecting trend data and generating trend graphs
      (8) Enabling and assigning alarms and messages to reporting actions/groups
      (9) Report generation and ‘third party software’
      (10) Backing up software and data files
   b. Project Engineering Manual shall contain as a minimum:
      (1) System architecture overview
      (2) Hardware cut-sheets and product descriptions
      (3) The Contractor shall deliver six (6) sets of 'as-built' drawings. All drawings shall be reviewed after the final system checkout and updated to provide 'as-built' drawings. The system will not be considered complete until the 'as-built' drawings have received their final approval.
      (4) Installation, mounting and connection details for all field hardware and accessories.

(5) Commissioning, setup and backup procedures for all control modules/accessories, BAS server software, and database.
(6) Listing of basic terminology, alarms/messages, error messages and frequently used commands or shortcuts.

c. BAS Software Documentation shall contain as a minimum:
(1) The Contractor shall provide a printout all Graphical Programs, detailing their application to specific HVAC equipment and electrical/mechanical subsystems, together with a glossary or icon symbol library detailing the function of each graphical icon. Revisions made as a result of the submittal process, during the installation, start-up or acceptance portion of the project, shall be accurately reflected in the "as-builts".
(2) Graphical representation of the mechanical equipment hierarchy for the project including all equipment controlled by the BAS. For example: a VAV terminal box may be the source for increased cooling demand and require the primary VAV AHU to operate which, in turn, requires the chillers to operate.
(3) Detailed listing of all alarm and event messages programmed for designated mechanical/electrical equipment and required operator action.

C. Acceptance Test

1. Acceptance Testing. Upon completion of the installation, the Contractor shall start up the system and perform all necessary calibration, testing, and debugging operations. The Contractor in the presence of the Owner's representative shall perform an acceptance test.
2. Notice of Completion. When the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, a "notice of completion" shall be issued and the warranty period shall start.

D. System Training

1. System Use Instructions: Controls Contractor shall provide 24 Hours of training for designated personnel in the operation, maintenance, and programming of the system.

PART 2. - BAS SERVER & WEB BROWSER GUI

2.01 SYSTEM OVERVIEW

A. The BAS contractor shall provide system software based on a server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using ASHRAE's BACnet/IP protocol. Server shall be accessed using a web browser over the DDC system intranet provided under this contract and remotely over the Internet.

B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support Microsoft Internet Explorer browsers (6.x or later versions), and Windows as well as non-Window operating systems. No special software, (active-x components or fat java clients) shall be required to be installed on the PC's / PDA's used to access the BAS via a web browser.

C. The BAS server software must support at least the following server platforms (Windows NT, Sun Solaris and Linux). The BAS server software shall be developed and tested by the manufacturer of the system standalone controllers and network controllers/routers. Third party manufactured and developed BAS software is not acceptable.

D. The web browser GUI shall provide a completely interactive user interface and must offer the following features as a minimum:

1. Trending
2. Scheduling
3. Downloading Memory to field devices
4. Real time 'live' Graphic Program Diagnostics for troubleshooting
5. Tree Navigation
6. Parameter change of properties
7. Setpoint Adjustments
8. Alarm / Event information
9. Configuration of operators
10. Execution of global commands

E. Software Components

1. All software components of the BAS system software shall be installed and completed in accordance with the specification. BAS system components shall include:
   a. Server Software, Database and Web Browser Graphical User Interface
   b. System Configuration Utilities for future modifications to the system
   c. Graphical Programming
   d. Direct digital control software
   e. Application Software

F. BAS Server Database

1. The BAS server software shall utilize a Java DataBase Connectivity (JDBC) compatible database such as: MS Access, MS SQL 7.0, Oracle 8i or IBM DB2. BAS systems written to Proprietary databases are **NOT** acceptable.

G. Database Open Connectivity

1. The BAS server database shall be Java DataBase Connectivity (JDBC) compatible, allowing real time access of data via the following standard mechanisms:
   a. Common Object Request Broker Architecture (CORBA)
   b. OLE/OPC (for Microsoft Client's/Server platform only)
   c. Import/Export of the database from or to XML (extensible Mark-up Language)

H. Communication Protocol(s)

1. The native protocol for the BAS server software shall be BACnet as defined by ASHRAE standard SPC135. In addition, the software shall be able to support concurrent operation of multiple standard and non-standard protocols such as:
   a. MODBUS
   b. SMNP

I. Cross Platform Capability

1. The BAS system software (client and server) shall be operating system and hardware agnostic, being able to run on Windows 98, Windows 2000, Windows NT, Sun Microsystems Solaris and Red Hat Linux

J. Thin Client – Web Browser Based

1. The GUI shall be thin client or browser based and shall meet the following criteria:

a. Web Browser's for PC's: Only a 6.x browser (Explorer/Navigator) will be required as the GUI, and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet. A firewall shall be installed (as necessary) to protect the customer's Intranet.
b. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall be encrypted using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP).
c. PDA's: BAS Server software must support other browsers used by Personal Digital Assistants like 3Com Palm Pilots and other Internet appliances specified herein.

2.02 WEB BROWSER GRAPHICAL USER INTERFACE

A. Web Browser Navigation

1. The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish **2.2 B thru 2.2 J** of this specification. The Web Browser GUI shall (as a minimum) provide a Navigation Pane for navigation, and an Action Pane for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.

B. Login

1. On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator's role privileges, and geographic area of responsibility (see 3.2 J below).

C. Navigation Pane

1. The Navigation Pane shall comprise a Navigation Tree which defines a geographic hierarchy of the proposed BAS system. Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and graphic pane defined in 2.2 D shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the graphic corresponding to the highlighted position in the navigation tree. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
   a. Geographic View shall display a logical geographic hierarchy of the system including cities, sites, buildings, building systems, floors, equipment and BACnet objects.
   b. Network View shall display the hierarchy of the actual BACnet IP Intranet network. This can include: Systems, Site, Networks, Routers, Half-Routers, Devices, Equipment and all the BACnet Objects in a device.
   c. Groups View shall display Scheduled Groups and custom reports.
   d. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

D. Action Pane

1. The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. By clicking on a button, an operator shall be able to select the following system page, corresponding to the highlighted area/equipment in the navigation tree:
   a. Graphics: Using animated gifs or other graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings of each individual piece of equipment with live variable statuses, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh at a rate defined by the operator.
   b. Properties: Shall include graphic controls and text for the following: Locking or overriding BACnet objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress a 'accept/cancel' button.
   c. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree) and in compliance with section 2.2.G
   d. Events: Shall be used to view alarm event information geographically (using the navigation tree), acknowledge events, sort events by category, actions and verify reporting actions.
   e. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
   f. Logic - Live Graphic Programs: Shall be used to display a 'live' graphic programs of the control algorithm for the mechanical/electrical system selected in the navigation tree. All control outputs and inputs shall displayed on the program giving real-time statuses for use in operator troubleshooting.
2. The following actions shall be accomplished by clicking appropriate buttons/menus in the graphic window: Log In/Out, Print and Hide/Show Navigation Pane.

E. Color Graphics

1. The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated gif's, active setpoint graphic controls and valid web content (like local weather forecast) shall be used to enhance usability:
   a. Display Size: The GUI workstation software shall graphically display in 1024 by 768 pixels 24 bit True Color.
   b. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
   c. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see section 3.2 F below). The colors shall be updated dynamically as a zone's actual comfort condition changes in real-time. Locations of space sensors shall also be shown for each zone. The intent of the specification is to enable the operator to readily assess problems at a glance.
   d. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
   e. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
      (1) Each piece of equipment monitored or controlled including each terminal unit

(2) Each building
(3) Each floor and zone controlled.

F. Zone Setpoint Adjustments

1. Color floor plans displayed via a web browser shall utilize a contiguous band of colors, each corresponding to actual zone temperatures relative to the desired heating and cooling setpoints. The ideal temperature shall be shown as a green color band. Temperatures slightly warmer than ideal shall be shown in yellow, and even warmer temperature band shall be shown in orange. Temperatures slightly cooler than ideal shall be light blue, and even cooler temperatures shall be shown as dark blue. All alarm colors shall be in red.

G. Hierarchical Schedules

1. Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room or choose to apply a hierarchical schedule to the entire system, site or floor area.
2. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
   a. BACnet Schedules: Schedules shall comply with the BACnet standard, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
      (1) Types of schedule shall be Normal, Holiday or Override
      (2) A specific date,
      (3) A range of dates,
      (4) Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
      (5) Wildcard (example, allow combinations like second Tuesday of every month).
   b. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
   c. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ‘individual tenant’ group – who may occupy different areas within a building or buildings. Schedules applied to the ‘tenant group’ shall automatically be downloaded to control modules affecting spaces occupied by the ‘tenant group’.
   d. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler, and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
   e. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator.
   f. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

g. Schedule Distribution: For reliability and performance, instead of maintaining a single schedule in a field device that writes over the network to notify other devices when a scheduled event occurs, field devices will only keep their part of the schedule locally. The BAS server software shall determine which nodes a hierarchical schedule applies to and will create/modify the necessary schedule objects in each field device as necessary.

H. Events (& Alarms)

1. Events and alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an 'Events' view. Events, alarms, and reporting actions shall have the following capabilities:
   a. Events View: Each event shall display an Event Category (using a different icon for each event category), date/time of occurrence, current status, event report, and a URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
   b. Event Categories: The operator shall be able to create, edit or delete event categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each Event category, enabling the operator to easily sort through multiple events displayed using a built-in filter.
   c. BACnet Event Templates: BACnet Event template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of event, acknowledgement requirements, high/low limit and out of range information.
   d. Event Areas: Event Areas enable an operator to assign specific Event Categories to specific Event Reporting Actions.
   e. Event Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
   f. Event Configuration: Operators shall be able to define the type of events generated per BACnet object. A 'network' view of the Navigation Tree shall expose all BACnet objects and their respective Event Configuration. Configuration shall include assignment of event, alarm, type of Acknowledgement and notification for return to normal or fault status.
   g. Event Summary Counter: The view of events in the Graphic Pane shall provide a numeric counter, indicating how many events are active (in alarm), require acknowledgement, and total number of events in the BAS Server database.
   h. Persistent Data. The system shall allow for external systems to access the event instance data. Event data shall be stored and queried in the database in a relational manner. At a minimum, the fields to be stored in the database are:
      - Event Source
      - Event Generation Time
      - Acknowledge Required Flag
      - Delivery Priority
      - BACnet Event Type
      - Event Message Text
      - Classification of Event
      - Event Acknowledgement Time
      - Return to Normal Time
      - Operator Comments
      - Who Acknowledged the Event
      - BACnet Event Parameter

   i. Event Auto-Deletion: Events that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
   j. Event Reporting Actions: Event Reporting Actions specified shall be automatically launched (under operator defined conditions) after an event is received by the BAS

server software. Operators shall be able to fully define these Reporting Actions using the Navigation Tree and Graphic Pane in the web browser GUI. Reporting Actions shall be as follows:

(1) Print: Alarm/Event information shall be printed to the BAS server's PC or a networked printer.
(2) Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts.
(3) **Note:** Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
(4) File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
(5) Write Property: The write property reporting action updates a property value in a hardware module.
(6) SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an event.
(7) Run External Program: The Run External Program reporting action launches specified program in response to an event.

k. Event Simulator: The web browser GUI user shall provide an Event Simulator to test assigned Reporting Actions. The operator shall have the option of using current time or scheduling a specific time to generate the Event. Utilizing the Navigation Tree and drop-down menus in the Graphic Pane, the operator shall be able to select the Event Type, Status, Notification, Priority, Message, and whether acknowledgement is required.

l. External Injection of Events. The BAS server software shall provide a CORBA interface for external injection of events, allowing the system to receive/report events generated from external source other than the BAS system.

l. Trends

1. Trends shall conform to the BACnet Trend Log Object specification. The system shall be able to trend and display graphically all analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
2. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
3. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the BACnet object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory
4. Resolution. Sample intervals shall be as small as one (0.1) second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for display that have different trend intervals, the system will automatically scale the axis.
5. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
6. Zoom. It shall be possible to zoom-in on a particular section of a trend for more detailed examination.

7. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.

J. Security Access

1. Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:
   a. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges. Systems that use cryptic Boolean numbers to define system access are not acceptable.
      (1) View Privileges shall comprise Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
      (2) Edit Privileges shall comprise Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
      (3) Function Privileges shall comprise Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.
   b. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree.

2.03 GRAPHICAL PROGRAMMING

A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in standalone control modules. Any system that does not use a drag and drop method of graphical icon programming as described herein shall be unacceptable. GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence of operation. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.

B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

1. Graphic Sequence
   a. The clarity of the graphic sequence must be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.
2. Simulation
   a. Full simulation capability shall be provided with the graphic programming. Operator shall be able to fully simulate the constructed control sequence prior to downloading into field control modules. Simulation capabilities shall include step-by-step, accelerated time, and operator defined simulation criteria like outside

weather, demand, and communication status. Multiple graphic programs shall be simulated and displayed in split screens at the same time.

3. GPL Capabilities
   a. The following is a minimum definition of the capabilities of the Graphic Programming software:
      (1) Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
      (2) Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
      (3) BACnet Points: Shall be points that comply with the BACnet structure as defined in the BIBB's Addendum B1/B2, and the BACnet standard.
      (4) Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
      (5) Wires: Shall be graphical elements used to form logical connections between microblocks and between logical I/O. Different wire types shall be used depending on whether the signal they conduct is analog or digital.
      (6) Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection; i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
      (7) Parameter: A parameter shall be a value that may be tied to the input of a microblock.
      (8) Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields and shall contain 'push buttons' for the purpose of selecting default parameter settings.
      (9) Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes it function.
      (10) Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
      (11) Live Graphical Programs: The Graphic Programming software must support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode. For each piece of HVAC equipment, the graphic program shall be complete and viewed on one screen. For example, a graphic program used for an Air Handling Unit shall not be broken down into separate components and require an operator to view only one component at any one time.

PART 3. - PRODUCTS HARDWARE

3.01 BAS SERVER HARDWARE (Existing)

A. Computer Configuration (One BAS server to be provided by control contractor under this project, unless there is an existing BAS Server furnished by this Contractor.)

1. Central Server. The BAS Contractor shall provide a server configuration that includes the following components as a minimum:
   a. Server Class computer ie: Dell Poweredge SC430
   b. Operating system-Windows 2003 Server
   c. Processor – 3GHZ P4, minimum 3 GB RAM

d. 80GB HDD, SCSI
e. CD – CDRW
f. 2 Button Mouse
g. 101 keyboard
h. 17” Monitor
i. SVGA Display card capable of 1024 X 768 resolution in true Color (32bit)
j. 10/100 Ethernet NIC
k. IE 6.0 or later
l. Database engine – MS Access Db < 500MB,MSDE, MS SQL Server

B. Standard Client (Hardware Independent) (Existing)

1. The thin-client browser interface shall be hardware agnostic, meaning it will support Microsoft browser (6.x versions) as well as most common server platforms (Windows NT, Sun Solaris and Linux). No special software, (active-x components or fat Java clients) shall be required to be installed on the PC’s / PDA’s used to access the BAS via a web browser. The following is the minimum suggested hardware requirements for a Windows/Intel client:
   a. 700Mhz, PIII or higher CPU
   b. 256Mb of RAM minimum
   c. 20 gigabyte hard disk, SVGA Card with 1024 x 768, 24-bit True Color, 24X CD Rom Drive, 17” SVGA Color Monitor
   d. Operating system for the computer operator workstation server shall be Microsoft Windows XP,2000 or RedHat Linux 6.0 or Sun Solaris 7.0
   e. Internet Explorer 6.x
   f. Connection to the Intranet/Internet
2. No client hardware is required under this project if the BAS server can act as client in addition to the BAS server applications. Any owner/customer computers may act as client if the client computer has a 6.X browser and has connection capability to the DDC intranet/server.

3.02 NETWORK ROUTERS & BRIDGES

A. The DDC/BAS controller network shall use BACnet as its native communication protocol. Network bridges and routers must be of a modular design to ensure reliability and system performance.

1. BACnet Router

B. The central system shall use the DDC/BAS Local Area Network (LAN) provided under this contract for communication. The communication between the central server and the controllers shall be BACnet/IP. A router shall be provided, as required, to bridge BACnet/IP and the data link used between the controllers (BACnet ARCNET and BACnet MS/TP). Proprietary networks and proprietary protocols are not acceptable.

1. Firmware Updates: The BACnet Router must utilize FLASH memory to allow firmware updates to be performed remotely.

3.03 STANDALONE CONTROLLERS

A. General Purpose Multiple Application Controllers

1. BACnet BIBBS: General Purpose Multiple Application controllers must use BACnet as the native communication protocol between controllers.

2. Communication Speed: Controllers shall communicate at a minimum of 156 Kbps using ARCNET implemented over EIA-485 using an unshielded twisted pair at the Data Link Layer.
3. General Specification: Each General Purpose Multiple Application Controller must be capable of standalone direct digital operation utilizing its own 32 bit processor, non-volatile flash memory, input/output, 12 bit A to D conversion, hardware clock/calendar and voltage transient and lightning protection devices. A separate co-processor shall be used for communications to the controller network. All non-volatile flash memory shall have a battery backup of at least five years. Firmware revisions to the module shall be made from the BAS server or remotely over the Intranet or Internet. Controllers that require component changes to implement firmware revisions are not acceptable.
4. Point Expansion: The General-Purpose Multiple Application Controllers shall be expandable to the specified I/O point requirements. Each controller shall accommodate multiple I/O Expander Modules via a designated expansion I/O bus port. These expander modules shall expand the total point capacity of each controller up to 192 points where specified. The controller, in conjunction with the expansion modules, shall act as one standalone controller.
5. Point Programming: All point data, algorithms and application software within a controller shall be custom programmable from the operator workstation.
6. Program Execution: Each General-Purpose Multiple Application Controller shall execute application programs, calculations, and commands via a 32-bit microcomputer resident in the controller. All operating parameters for application programs residing in each controller shall be stored in read/writable nonvolatile flash memory within the controller and will be able to upload/download to/from the BAS Server.
7. Self-Test Diagnostics: Each controller shall include self-test diagnostics, enabling the controller to report malfunctions to the router and BAS Server.
8. PID Loops: Each General-Purpose Multiple Application Controller shall contain both software and firmware to perform full DDC Proportional, Integral, Derivative (PID) control loops and programs.
9. Input-Output Processing:
    a. Digital Outputs shall be relays, 24 Volts AC or DC maximum, 3-amp maximum current. Each configured as normally open or normally closed using jumpers and either dry contact or bussed. Each output shall have a manual Hand-Off-Auto switch to allow for override and an LED to indicate the operating mode of the output. Triac outputs are unacceptable.
    b. Universal Inputs shall be Thermistor (BAPI Curve II) 10K Ohm at 77°F (25°C), 0-5VDC, 10K Ohm maximum source impedance, 0-20mA - 24 VDC loop power, 250 Ohm input impedance, dry contact - 0.5mA maximum current.
    c. Analog Output shall be electronic, voltage mode 0-10VDC or current mode 4-20mA.

B. General Purpose Single Application Controllers

1. BACnet BIBBS: The General-Purpose Single Application Controllers must use BACnet as the native communication protocol between controllers.
2. Communication Speed: Controllers shall communicate at a minimum of 156 Kbps using ARCNET implemented over EIA-485 using an unshielded twisted pair at the Data Link Layer.
3. General Specification: General Purpose Single Application controllers must be capable of stand-alone DDC operation utilizing its own 32 bit processor, nonvolatile flash memory, input/output, 8 bit A to D conversion, hardware clock/calendar and voltage transient protection devices. A separate co-processor shall be used for communications to the controller network. All RAM memory shall have a battery backup of at least five years. Firmware revisions to the module shall be made from the BAS server, or remote

locations over the Internet. Controllers that require component changes to implement Firmware revisions are not acceptable.

4. Point Programming: All point data, algorithms, and application software within the controllers shall be custom programmable from the Operator Workstation.
5. Program Execution: Each General-Purpose Single Application Controller shall execute application programs, calculations, and commands via a 32-bit microcomputer resident in the controller. All operating parameters for the application program residing in each controller shall be stored in read/writable nonvolatile flash memory within the controller and will be able to upload/download to/from the Operator Workstation.
6. Self-Test Diagnostics: Each controller shall include self-test diagnostics, enabling the controller to report malfunctions to the router and BAS Server input.
7. PID Loops: Each General Purpose Single Application Controller shall contain both software and firmware to perform full DDC PID control loops.
8. Rooftop Mounting: The General Purpose Single Application Controllers shall be capable of being mounted directly in or on rooftop AHU equipment.
9. Operating Temperature: The General Purpose Single Application Controllers shall be capable of proper operation in an ambient temperature environment of -20°F to +150°F (-28.9° to 65.6°C).
10. Input-Output Processing:
    a. Digital Outputs shall be relays, 24 Volts AC or DC maximum, 3 amp maximum current. Each output shall have a manual Hand-Off-Auto switch to allow for override and an LED to indicate the operating mode of the output. **Triac outputs are unacceptable.**
    b. Universal Inputs shall be Thermistor (BAPI Curve II) 10K Ohm at 77°F (25°C), 0-5VDC - 10K Ohm maximum source impedance, 0-20mA - 24 VDC loop power, 250 Ohm input impedance, Dry Contact - 0.5mA maximum current.
    c. Analog Electronic Outputs shall be voltage mode 0-10VDC or current mode 4-20mA.
    d. Enhanced Zone Sensor Input shall provide one thermistor input, one local setpoint adjustment, one timed local override switch, and an occupancy LED indicator.

3.04 FIELD HARDWARE/INSTRUMENTATION

A. Temperature Sensing Devices

1. Type & Accuracy. Temperature sensors shall be of the type and accuracy indicated for the application. Sensors shall have an accuracy rating within 1% of the intended use temperature range.
2. Outside Air Temperature Sensors. Outside air temperature sensors accuracy shall be within +1°F (0.5°C) in the range of -52°F to 152°F (-46.6°C to 66.6°C).
3. Room Temperature Sensors. Room temperature sensors shall have an accuracy of +0.36°F (0.25°C) in the range of 32°F to 96°F (0°C to 35.5°C).
4. Chilled Water and Condenser Water Sensors. Chilled water and condenser water sensors shall have an accuracy of +0.25°F (0.15°C) in their range of application.
5. Hot Water Temperature Sensors. Hot water temperature sensors shall have an accuracy of +0.75°F (0.3°C) over the range of their application.

B. Pressure Instruments

1. Differential Pressure and Pressure Sensors: Sensors shall have a 4-20 MA output proportional signal with provisions for field checking. Sensors shall withstand up to 150% of rated pressure, without damaging the device. Accuracy shall be within ±2% of full scale. Sensors shall be manufactured by Leeds & Northrup, Setra, Robertshaw, Dwyer Instruments, Rosemont, or be approved equal.

2. Pressure Switches: Pressure switches shall have a repetitive accuracy of ±2% of range and withstand up to 150% of rated pressure. Sensors shall be diaphragm or bourdon tube design. Switch operation shall be adjustable over the operating pressure range. The switch shall have an application rated Form C, snap-acting, self-wiping contact of platinum alloy, silver alloy, or gold plating.

C. Flow Switches

1. Flow switches shall have a repetitive accuracy of ±1% of their operating range. Switch actuation shall be adjustable over the operating flow range. Switches shall have snap-acting Form C contacts rated for the specific electrical application.

D. Humidity Sensors

1. Sensors shall have an accuracy of ±25% over a range of 20% to 95% RH.

E. Current Sensing Relays

1. Relays shall monitor status of motor loads. Switch shall have self-wiping, snap-acting Form C contacts rated for the application. The setpoint of the contact operation shall be field adjustable.

F. Output Relays

1. Control relay contacts shall be rated for 150% of the loading application, with self-wiping, snap-acting Form C contacts, enclosed in dustproof enclosure. Relays shall have silver cadmium contacts with a minimum life span rating of one million operations. Relays shall be equipped with coil transient suppression devices.

G. Solid State Relays

1. Input/output isolation shall be greater than 10 billion ohms with a breakdown voltage of 15 V root mean square, or greater, at 60 Hz. The contact operating life shall be 10 million operations or greater. The ambient temperature range of SSRs shall be 20°F-140°F. Input impedance shall be greater than 500 ohms. Relays shall be rated for the application. Operating and release time shall be 10 milliseconds or less. Transient suppression shall be provided as an integral part of the relays.

H. Valve and Damper Actuators

1. Electronic Direct-Coupled: Electronic direct-coupled actuation shall be provided.
2. Actuator Mounting: The actuator shall be direct-coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The fastening clamp assemble shall be of a 'V' bolt design with associated 'V' shaped toothed cradle attaching to the shaft for maximum strength and eliminating slippage. Spring return actuators shall have a 'V' clamp assembly of sufficient size to be directly mounted to an integral jackshaft of up to 1.05 inches when the damper is constructed in this manner. Single bolt or screw type fasteners are not acceptable
3. Electronic Overload Sensing: The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
4. Power Failure/Safety Applications: For power failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.

5. Spring Return Actuators: All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
6. Proportional Actuators: Proportional actuators shall accept a 0 to 10VDC or 0 to 20mA control input and provide a 2 to 10VDC or 4 to 20mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10VDC position feedback signal.
7. 24 Volts (AC/DC) actuators: All 24VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10VA for AC or more than 8 watts for DC applications. Actuators operating on 120VAC power shall not require more than 10VA. Actuators operating on 230VAC shall not require more than 11VA.
8. Non-Spring Return Actuators: All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque shall have a manual crank for this purpose.
9. Modulating Actuators: All modulating actuators shall have an external, built-in switch to allow reversing direction of rotation.
10. Conduit Fitting & Pre-Wiring: Actuators shall be provided with a conduit fitting and a minimum 3ft electrical cable, and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
11. U.L. Listing: Actuators shall be Underwriters Laboratories Standard 873 listed and Canadian Standards Association Class 4813 02 certified as meeting correct safety requirements and recognized industry standards.
12. Warranty: Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque and shall have a 2-year manufacturer's warranty, starting from the date of installation. Manufacturer shall be ISO9001 certified.

PART 4. - DDC SOFTWARE

4.01 OVERVIEW

A. The system shall continuously perform Direct Digital Control (DDC) functions at the local control module in a stand-alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. The operators shall use system provided displays for tuning of PID loops. These displays shall include the past three input variable values, the setpoint for the loop as well as the sample interval and the results of the proportional, integral and derivative effects on the final output.

1. Minimum Function
   a. Each control module shall perform the following functions:
      (1) Identify and report alarm conditions
      (2) Execute all application programs indicated on the I/O Summary table
      (3) Execute DDC algorithms
      (4) Trend and store data
2. Control Failure Mode
   a. In the event of a control module failure, all points under its control shall be commanded to the failure mode as indicated on the I/O Summary Table. All DDC software shall reside in the respective control module.
      (1) Orderly Shutdown: Power failures shall cause the control module to go into an orderly shutdown with no loss of program memory.
      (2) The HVAC system shall be programmed to allow an emergency shut down of all HVAC units to eliminate air intake and distribution from the building exterior while maintaining a positive pressure throughout the building.

(3) Automatic Restart: Upon resumption of power, the control module shall automatically restart and print out the time and date of the power failure and restoration at the respective Workstation system.
(4) Automatic Restart: The restart program shall automatically restart affected field equipment. The operator shall be able to define an automatic power up time delay for each piece of equipment under control.

PART 5. - APPLICATIONS SOFTWARE

5.01 GENERAL

A. The following applications software shall be provided for the purpose of optimizing energy consumption while maintaining occupant comfort:
1. Time of Day Scheduling (TOD)
a. The system shall be capable of the following scheduling features:
(1) Schedule by Type. Scheduling by building, area, zone, groups of zones, individually controlled equipment and groups of individually controlled equipment. Each schedule shall provide beginning and ending dates and times (hours: minutes). A weekly repeating schedule, i.e. between 8:00 a.m. and 5:00 p.m., Monday through Friday shall constitute one schedule, not five.
(2) Schedule in Advance. Dated schedules shall be entered up to nine (9) years in advance.
(3) Self-Deleting. Schedules shall be self-deleting when effective dates have passed.
(4) Leap Year. Leap years shall be adjusted automatically without operator intervention.

B. Optimum Start/Stop (OSS)/Optimum Enable/Disable (OED)

1. This application provides software to start and stop equipment on a sliding schedule based on the individual zone temperature and the heating/cooling capacity in °F/hour of the equipment serving that zone. The heating/cooling capacity value shall be operator adjustable. Temperature compensated peak demand limiting shall remain in effect during morning start up to avoid setting a demand peak.

C. Source Temperature Optimization (STO)

1. The system shall automatically perform source optimization for all air handling units, chillers and boilers in response to the needs of other downstream pieces of equipment, by increasing or decreasing supply temperature setpoints, i.e. chilled water, discharge air, etc. using owner defined parameters. In addition to optimization, the STO capability shall also provide for starting and stopping primary mechanical equipment based on zone occupancy and/or zone load conditions.

D. Demand Limiting (DL) - Temperature Compensated

1. The DL application shall be programmable for a minimum of six separate time of day KW demand billing rate periods. The system shall be capable of measuring electrical usage from multiple meters serving one building and each piece of equipment being controlled on the LAN shall be programmable to respond to the peak demand information from its respective meter.
a. Sliding Window: The demand control function shall utilize a sliding window method with the operator being able to establish the kilowatt threshold for a minimum of three adjustable demand levels. The sliding window interval shall be operator

selectable in increments of one minute, up to 60 minutes. Systems that incorporate rotating shed tables will not be acceptable.

b. Setpoints for Defined Demand Level: The operator shall have the capability to set the individual equipment temperature setpoints for each operator defined demand level. Equipment shall not be shed if these reset setpoints are not satisfied; rather the setpoint shall be revised for the different established demand levels. The system shall have failed meter protection, such that when a KW pulse is not received from the utility within an operator adjustable time period, an alarm will be generated. The system software will automatically default to a predetermined fail-safe shed level.

c. Information Archiving: The system shall have the ability to archive demand and usage information for use at a later time. System shall permit the operator access to this information on a current day, month to date and a year to date basis.

E. Day/Night Setback (DNS)

1. The system shall allow the space temperature to drift down [up] within a preset [adjustable] unoccupied temperature range. The heating [cooling] shall be activated upon reaching either end of the DNS range and shall remain activated until the space temperature returns to the DNS range.

F. Timed Local Override (TLO)

1. The system shall have TLO input points that permit the occupants to request an override of equipment that has been scheduled OFF. The system shall turn the equipment ON upon receiving a request from the local input device. Local input devices shall be push button (momentary contact), wind-up timer, or ON/OFF switches as detailed in the I/O summary.

G. Space Temperature Control (STC)

1. There shall be two space temperature setpoints, one for cooling and one for heating, separated by a dead band. Only one of the two setpoints shall be operative at any time. The cooling setpoint is operative if the actual space temperature has more recently been equal to or greater than the cooling setpoint. The heating setpoint is operative if the actual space temperature has more recently been equal to or less than the heating setpoint. There are two modes of operation for the setpoints, one for the occupied mode (example: heating = 72°F or 22°C, cooling = 76°F or 24.4°C) and one for the unoccupied mode (example: heating = 55°F or 12.7°C, cooling = 90°F or 32°C).
   a. Schedule: The occupied/unoccupied modes may be scheduled by time, date, or day of week.
   b. Color Code: One of seven colors shall be generated to represent the comfort conditions in the space and shall be displayed graphically at the operator station.
      (1) If the actual space temperature is in the dead band between the heating setpoint and the cooling setpoint, the color displayed shall be green for the occupied mode, representing ideal comfort conditions. If in the unoccupied mode, the color displayed shall be gray representing 'after-hours' conditions.
      (2) If the space temperature rises above the cooling setpoint, the color shall change to yellow. Upon further rise beyond the cooling setpoint plus an offset, the color shall change to orange. Upon further rise beyond the cooling setpoint plus the yellow band offset, plus the orange band offset, the color shall change to red indicating unacceptable high temperature conditions. At this point an alarm shall be generated to notify the operator.
      (3) When space temperature falls below the heating setpoint, the color shall change to light blue. Upon further temperature decrease below the heating

setpoint minus an offset, the color shall change to dark blue. Upon further space temperature decrease below the heating setpoint minus the light blue band offset minus the dark blue band offset the color shall change to red indicating unacceptable low temperature conditions. At this point an alarm shall be generated to notify the operator.

c. Operator Definable: All setpoints and offsets shall be operator definable. When in the occupied mode, start-up mode, or when heating or cooling during the night setback unoccupied mode, a request shall be sent over the network to other equipment in the HVAC chain, such as to an AHU fan that serves the space, to run for ventilation. The operator shall be able to disable this request function if desired.

d. Additional Cooling: When comfort conditions are warmer than ideal, indicated by the colors yellow, orange, and high temperature red, a request for additional cooling shall be sent over the network to other cooling equipment in the HVAC chain, such as a chiller. This information is to be used for optimization of equipment in the HVAC chain. The operator shall be able to disable this function if desired.

e. Additional Heating: When comfort conditions are cooler than ideal; indicated by the colors light blue, dark blue, and low temperature red; a request for additional heating shall be sent over the network to other heating equipment in the HVAC chain, such as a boiler. This information is to be used for optimization of equipment in the HVAC chain. The operator shall be able to disable this function if desired.

f. Cooling/Heating Setpoints: The cooling [and heating] setpoints may be increased [decreased] under demand control conditions to reduce the cooling (heating) load on the building during the demand control period. Up to three levels of demand control strategy shall be provided. The operator may predefine the amount of setpoint increase [decrease] for each of the three levels. Each space temperature sensor in the building may be programmed independently.

g. Optimum Start: An optimum start-up program transitions from the unoccupied setpoints to the occupied setpoints. The optimum start-up algorithm considers the rate of space temperature rise for heating and the rate of space temperature fall for cooling under nominal outside temperature conditions; it also considers the outside temperature; and the heat loss and gain coefficients of the space envelope (AI: Space Temperature).

h. PID Loop: A PID control loop, comparing the actual space temperature to its setpoint, shall modulate the dampers [and heating coil valve or heating stages in sequence] to achieve the setpoint target.

PART 6. - EXECUTION

6.01 PREPARATION

A. Protection of Persons and Property

1. Safety Precautions and Programs. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.
2. Safety of Persons and Property. The Contractor shall take all reasonable precautions and provide all reasonable protection to prevent damage, injury or loss to:
   a. All employees on the installation sites and all other persons who may be affected.
   b. All work, materials, and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody, or control of the Contractor or any Subcontractor or Sub-subcontractor.

c. Other property at the site or adjacent thereto. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders or any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. It shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

6.02 HARDWARE INSTALLATION

A. Utility Company Equipment

1. Owner shall arrange installation of electric billing meters, water meters, and gas meters with demand signal pulses, as indicated.

B. Wiring

1. The Contractor shall install wires for the room temperature sensors (from sensor to the appropriate control module).
2. The Contractor shall install all sensing devices and the wiring to modules.
3. The Contractor shall install all control and monitoring wiring in Mechanical Room.
4. Low voltage wire shall be not less than 18 AWG. All line voltage wire shall be THHN/TFFN, 600 volt rated.
5. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 23, and manufacturer's recommendations. Where the requirements of Section 230900 differ from Division 23, Section 230900 shall take precedence.
6. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 16.
7. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.
8. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.
9. Install wiring in raceway where subject to mechanical damage and all exposed locations such as mechanical, electrical, or service rooms.
10. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.
11. Do not install wiring in raceway containing tubing.
12. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 2 m (6 ft) intervals.
13. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.
14. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.
15. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
16. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
17. Use color-coded conductors throughout.
18. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

19. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.
20. Adhere to requirements in Division 16 where raceway crosses building expansion joints.
21. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.
22. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.
23. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (18”) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.
24. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.
25. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).
26. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.
27. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.
28. Verify entire network's integrity following cable installation using appropriate tests for each cable.
29. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.
30. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.
31. Label communication wiring to indicate origination and destination.
32. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

6.03 SMOKE DETECTORS

A. Smoke detectors approved for duct installation shall be provided by Division 26 for all air systems of 2000 cfm capacity or above or as indicated on the drawings, to automatically shut down the supply fan and close all smoke dampers (as required). Each detector shall have an integral relay and be capable of operating a remote. All wiring shall be in conduit.

B. Smoke detectors shall be furnished by Division 260000 and installed under Division 230000. All wiring between detector and fire alarm system shall be provided and installed under Division 260000. All wiring between detector and unit and between detector and EMSA shall be provided and installed under Division 230000. All wiring shall be in conduit.

6.04 FIRE ALARM INTERLOCK, EQUIPMENT INTERLOCK AND EMERGENCY

A. Provide relays in the starting circuits of all air moving equipment to stop operation when the building fire alarm system is activated as detected by the BAS. Contacts shall be installed in the central fire alarm panel for this signal; coordinate with fire alarm panel furnished under Division 16.

B. Provide on the face of the Central Control Panel and remote alarm panel an "Emergency Stop" switch. Switch shall be wired so that all air moving equipment will immediately shut down when switch is depressed.

C. Provide all interlock wiring between air-conditioning units, fans, dampers, space sensors, clocks, and other related equipment as necessary to achieve the specified operating sequence.

6.05 RELAYS

A. Provide relays in power wiring to stop and start exhaust fans, domestic water heaters, pumps, etc., as required. Relays shall be of the voltage and ampere rating required for the load served and shall have NEMA-1 enclosure.

6.06 DAMPER ACTUATORS

A. Damper actuators shall be 24-volt proportional motor operators.

6.07 VALVES

A. Control valves shall be electric operated. Actuators shall be mounted vertically above piping served or horizontally, no lower than the center line of the piping. Surrounding piping and equipment shall be located and valve location in piping shall be such that a minimum service clearance of 6" (or greater as required by the manufacturer's recommendations) is provided between the top of the valve actuator and the obstruction to facilitate maintenance and removal of actuator.

6.08 CONTROL PANELS

A. Furnish formed sheet metal control panels as required with locking door and hinges. All necessary relays, switches and peripheral devices shall be located inside panels. All electric devices shall be connected to numbered terminal strips. All control panels shall be centrally located.

END OF SECTION 238310

SECTION 260500 - GENERAL REQUIREMENTS, ELECTRICAL

PART 1. - GENERAL

1.01 WORK INCLUDED

A. This section is applicable to and a part of all Division 26 sections of the Project Manual.

1.02 QUALITY ASSURANCE

A. Publications

1. Copies: Obtain copies of trade association standards and publication wherever needed for proper execution of the work.
2. Publication Date: Comply with the issue of applicable standard or publication which is in effect at the date shown on these contract documents. Obtain approval from the Architect-Engineer to comply with a later issue of a standard or publication.
3. Conflicting Requirements: Report to the Architect-Engineer where application of a trade association standard or publication appears to be in conflict with the requirements of the contract documents.

B. Product Standards: Listed in the current edition of UL "Electrical Construction Materials Directory," if such a listing exists for the particular type of item specified.

C. Reference Standards:

1. Meet or exceed the recommendations and requirements of reference standards.
2. Submit proof (stamp, label, published listing or independent certified test).

D. Servicing: Provide products supported by a service organization that is reasonably convenient to the site.

E. Nameplates:

1. Securely attach to each major component of equipment, visible and readable, name, address, and model identification number on a plate.
2. Do not cover with paint, insulation, or other material.

F. Manufacturer's Instructions: Follow the manufacturer's published instructions in preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated by the Contract Documents.

G. Capacities: Meet or exceed capacity requirements indicated. Stay within maximums, minimums and other limits. Prevent components or systems from becoming inoperative or damaged because of start-up, overload, or other conditions.

H. Suitability: Provide products suitable for the pressures, temperatures, fluids, voltages, environmental conditions, and other conditions encountered by the indicated application.

I. Protection from Moving Parts: Provide enclosures and guards for belts, pulleys, chains, gears, couplings, projecting set-screws, keys, hot surfaces and other hazardous parts located where persons can come in close proximity.

J. Spare Parts Data: Provide spare parts data prior to Substantial Completion.

K. Standard Products: Provide standard cataloged products of manufacturers regularly engaged in the manufacture of products that essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years.

L. Connections to Utilities:

1. Provide the services of a person or company approved by the respective utility authority to make connections to:
   a. Water supplies.
   b. Sanitary sewer.
   c. Storm sewer.
   d. Gas.
   e. Electrical power.
   f. Telephone.
   g. Other utilities.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

C. Submittals:

1. **Electrical Product Data Submittals to be organized and submitted as ONE complete submittal** as follows (excludes shop drawings):
   a. Cover Sheet listing project name, date, GC, Subcontractor
   b. Index Sheet
   c. The contractor shall include a formal letter to the engineer, included in the submittal after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   d. Organize all required items by numerical specification section with tabbed dividers including section number and title. Each section to provide a subsequent index cover.
   e. Submittals not organized as indicated above may be rejected without review.
2. The contractor may require his subcontractors to provide coordination drawings indicating all trades, such drawings will not be reviewed by the engineer.
3. Unless agreed upon with the engineer, electronic submittals are not acceptable.
4. Shop drawings are to fully drawn/designed and coordinated by the contractor. Any replication of original bid documents will be rejected.

D. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract.
   b. Approved fixture/equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   e. Any and all data and/or plans required during construction.
   f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
   g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

E. Training:

1. Upon completion of the work and at a time designated by the Owner’s representative, provide a formal training session for the Owner’s operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner’s representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner’s representative and Engineer as a condition of final acceptance.

F. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

G. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered

separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.

2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle products carefully to prevent internal component damage, breaking or denting.

B. Store products in clean, dry space, protected from dirt, fumes, water, construction debris and physical damage.

C. Do not install damaged equipment or materials.

1.05 PRODUCT APPLICATION, INSTALLATION, AND OPERATION

A. General: For products incorporated into the Work, the Contractor shall ascertain the following:

1. Application:
   a. The manufacturer's representatives have reviewed the proposed application of their products.
   b. The application and product are compatible regarding:
      (1) Operation.
      (2) Electric Source.
      (3) Piping.
      (4) Controls.
      (5) Location.
      (6) Proximity to other products and elements of the work.
      (7) Structural support and integrity.
      (8) Other pertinent factors.

B. Installation: The installers were instructed in the manufacturer's recommended procedure for installation, and the product was installed according to the manufacturer's recommendations.

C. Operation: The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up, the products are operating as intended by the Contract Documents, and the application and product are compatible regarding the same factors named above.

D. Installation: Submit letter following installation of the manufacturer's product stating the following:

1. The installers were instructed in the manufacturer's recommended procedure for installation.
2. The product was installed according to the manufacturer's recommendations.

E. Operation: Submit letter with Owner's final documents stating the following:

1. The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up.
2. The products are operating as intended by the Contract Documents.
3. The application and product are compatible regarding the same factors named above.

F. Signature on Letter: By manufacturer's representative

PART 2. - PRODUCTS

Not Used

PART 3. - EXECUTION

3.01 TESTING

A. Reference individual sections for required testing.

END OF SECTION 260500

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 260501 - ELECTRICAL SPECIAL PROVISIONS

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The work contemplated under this section of the specifications includes the furnishing of all labor and materials necessary for the complete installation of wiring in conduit for lighting and power, etc., as hereinafter specified and as shown on the Drawings.

B. Work includes, but is not limited to, the following:

1. Administrative Communication System.
2. Aiming of fixtures.
3. Area lights.
4. Clock and bell system.
5. Computer cable rough in.
6. Connections to equipment furnished under other sections of these specifications.
7. Control wiring and power.
8. Dry type transformers.
9. Fire alarm.
10. Intercom.
11. Interior building lighting.
12. Manholes.
13. Other systems as required or specified.
14. Outdoor lighting systems.
15. Panel boards.
16. Photo controls
17. Poles, brackets and platforms.
18. Public address system.
19. Relays and contactors.
20. Service entrance equipment.
21. Surface Raceway/Wiring System.
22. Switchboards.
23. Telephone, Antenna rough in.
24. Testing of wire and cable insulation.
25. Wiring for lighting and power.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General reference is made to all other Divisions of these Specifications as they relate to Electrical work.

B. In general, the contractor shall become familiar with the electrical work described elsewhere and provide the necessary wiring components and labor to accomplish a completed workable system, whether or not it is specifically called for or enumerated in the "Electrical Drawings" or "Electrical Specifications".

C. Particular reference is made to:

1. Division 5: Metals
2. Division 9: Finishes
3. Division 11: Equipment
4. Division 14: Conveying Systems

5. Division 22: Plumbing
6. Division 23: Mechanical
7. Division 27: Communications
8. Division 28: Electronic Safety and Security
9. Division 31: Earthwork
10. Division 33: Utilities

1.03 TRENCH SAFETY SYSTEMS

A. During the construction of the project the Contractor shall utilize adequate safety systems meeting Occupational Safety and Health Administration (OSHA) standards for trench excavation when said trench excavation exceeds a depth of five feet, and at other occasions as appropriate for worker safety. (Title 29 CFR Part 1;926, Subpart P.) In addition, Contractor shall implement for its employees, sub-contractors, agents, and representatives, a safety program for any trench system utilized in this construction project.

B. The Term "Trench" and "Trench System" includes excavation for manholes, tanks, sumps, catch basins, valve boxes, pull boxes, pipe, conduit, piers, and other appurtenances and structures related to the systems being trenched for.

1.04 QUALITY ASSURANCE AND STANDARDS

A. In addition to the requirements outlined in other sections of the specifications the following standards are imposed as applicable to the work in each instance:

1. NECA standards for installation.
2. NFPA No. 70, National Electric Code.
3. Local Codes and Ordinances.
4. COG Standard Specifications for Public Works Construction.

B. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof. Any such additional work shall be performed at no additional cost to the Owner.

C. Materials and components shall be UL listed and approved for the purpose intended.

D. The Contractor shall obtain all permits required to commence work and, upon completion of the Work, obtain and deliver to the Owner's Representative a Certificate of Inspection and Approval from the State Board of Fire Underwriters, the City, State and other authority having jurisdiction. Required permit fees shall be paid by the Contractor.

1.05 LISTING OF ASSOCIATIONS AND STANDARDS

A. ANSI: American National Standards Institute 1430 Broadway; New York, NY 10018.

B. ASTM: American Society for Testing and Materials, 1916 Race Street; Philadelphia, PA 19103.

C. IEEE: Institute of Electrical & Electronics Engineers, 345 East 47th St.; New York, NY 10017.

D. ICEA: Insulated Cable Engineers Association, P O Box P, South Yarmouth, MA 02664.

E. NEC: National Electrical Code; NFPA No. 70-87.

F. NECA: National Electrical Contractors Association, Inc., 7315 Wisconsin Ave.; Washington, DC

20014.

G. NEMA: National Electrical Manufacturers Association, 155 East 44th St; New York, NY 10017.

H. NESC: National Electrical Safety Code, ANSI 2.

I. NFPA: National Fire Protection Association, 60 Batterymarch Street; Boston, MA 02110.

J. OSHA: Occupational Safety and Health Administration, US Dept of Labor; Washington, DC 20402.

K. UL: Underwriters Laboratories, Inc., 333 Pfigsten Road; Northbrook, IL 60062.

1.06 ELECTRICAL SYMBOLS

A. The electrical contract drawings are diagrammatic and show requirements by the use of graphic symbols. In general, these are the recognized symbols of the industry and of the engineering profession.

B. Listing of Symbols: The listing of specific graphic symbols used to show the electrical work on the contract documents is shown on the drawings.

1.07 SUBMITTALS

A. Refer to other sections for general requirements concerning work related submittals.

B. The Contractor shall review all submittals for compliance with the requirements and intent of the contract and shall evidence his review and approval by a signed and dated stamp or acknowledgment of his review and approval. The contractor shall further note each and every deviation from the requirements or intent of the contract documents. Submittals which do not attest to the foregoing will not be considered as the required submittals and will be returned to the Contractor for his further consideration.

C. Submit the following manufacturers product data, completely marked and annotated to include all options, materials, and finishes as appropriate to the equipment:

1. Administrative communication system.
2. Ballasts.
3. Circuit Breakers.
4. Clock and bell system.
5. Contactors.
6. Distribution Panel boards.
7. Dry Type Transformers.
8. Fuses.
9. Fusible Switches.
10. Lamps.
11. Lighting and Appliance Panel boards.
12. Lighting Poles & Appurtenances.
13. Lighting Fixtures.
14. Medium Voltage Cable & Terminators.
15. Medium Voltage Oil Switch & Controls.
16. Motor Starters.
17. Nurse Call System.
18. Oil Filled Transformers.
19. Overhead pole line products.

20. Photocells.
21. Relays.
22. Safety Switches.
23. Service Conduit.
24. Switchboards.
25. Time Clocks.
26. Wire Manufacturer.
27. Wiring Devices.

D. Submit the following shop drawings:

1. Generator set foundation drawings.
2. Lighting Poles and appurtenances.
3. Relocatable wiring system schematic and layout.

E. Submittal Format:

1. Electrical Submittals to be organized as follows:
   a. Cover Sheet listing project name, date, GC, Subcontractor
   b. Index Sheet
   c. The contractor shall include a formal letter to the engineer, included in the submittal after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   d. Organize all required items by numerical specification section with tabbed dividers including section number and title. Each section to provide a subsequent index cover.
   e. Provide individual tabs for sections where practical including but not limited to area lighting, and interior building lighting.
   f. Submittals not organized as indicated above may be rejected without review.
2. Color selection: Some products require that a color selection be coordinated with the architect, such information on the products shall be submitted to the architect.
3. The contractor may require his subcontractors to provide coordination drawings, such drawings will not be reviewed by the engineer.
4. Unless agreed upon with the engineer, electronic submittals are not acceptable.
5. Shop drawings are to fully drawn/designed and coordinated by the contractor. Any replication of original bid documents will be rejected.

F. Submit the following certifications:

1. Compatibility with existing equipment.
2. Pole loading computations and seal.
3. Concrete mix slip certification.

1.08 PROJECT CLOSEOUT

A. Record Drawings: In addition to the requirements of Division 01 and General Conditions, record drawings shall include the following:

1. One line wiring diagram of the Medium voltage and Low voltage distribution systems.
2. Actual in place conduit and cable layouts with schedule of conduit sizes and number and size of conductors.
3. Layouts of the lighting arrangements.
4. Control wiring diagrams with terminal numbers and all control devices identified.

PART 2. - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Except as otherwise indicated, provide materials and equipment manufacturer's standard materials and components as indicated by their published product information; designed and constructed as required for a complete installation.

2.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle electrical materials and equipment carefully to prevent internal components damage, breaking, denting, and scoring the enclosure finish. Do not install damaged equipment or materials.

B. Store electrical materials and equipment in clean dry space. Protect same from dirt, fumes, water, construction debris and physical damage.

C. Protect electrical from abuse or damage by other trades on the project. Do not permit electrical materials and equipment to be used for supports, work tables, scaffolds, etc.

2.03 CONCRETE FOR ELECTRICAL WORK

A. Refer to applicable Division 3 specification sections.

B. Concrete for electrical work shall be minimum 3000 psi after 28 days. Concrete shall be by reputable local ready mix company. Mix certifications shall accompany each load of concrete. Concrete shall be placed in accordance with accepted standards of placement. Owner's representative reserves the right to reject any concrete not mixed or poured in accordance with good practice. Such concrete shall be removed and replaced at the Contractor's sole expense. Owner's representative may require at least two (2) test cylinders be poured from each batch.

C. Reinforcing steel shall be placed as shown and scheduled.

PART 3. - EXECUTION

3.01 INSPECTION

A. Installer must examine the areas and conditions under which electrical equipment is to be installed and notify the Contractor and Owner's Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 TESTING

A. Perform in accordance with manufacturer’s printed testing procedures, applicable industry standards, ANSI standards, IEEE standards, NEMA standards and as directed by the Engineer.

B. Provide testing equipment in good working order and which complies with the applicable industry standards and manufacturer’s requirements. Include a list of testing equipment used and date of last calibration.

C. Test the following:

1. Feeder conductors to main switchboard.

2. Feeder conductors from switchboard to panelboards.
3. Grounding means all switchgear.
4. Grounding of the Electrical system neutral: Ground resistance shall not exceed 10 ohms.
5. Equipment grounds for each feeder: Ground resistance shall not exceed 25 ohms.
6. Grounds for each transformer: Ground resistance shall not exceed 25 ohms.
7. Perform all tests in the presence of the Engineer, Architect or the Owner in accordance with the requirements of this section.

D. Submit all results to the Engineer with ten (10) working days from the time the test is performed.

E. Document all test results and provide a signed report by the testing technician as witnessed. Reports shall include date, time, weather conditions, field conditions, test data, instruments used and a brief description of the test. Include reports in operation manuals.

3.03 INSTALLATION OF ELECTRICAL MATERIALS AND EQUIPMENT

A. Install electrical materials and equipment where shown and in accordance with recognized industry practices to ensure that the completed installation of electrical materials and equipment, and the various types of equipment which the electrical system serves the intended purposes and functions. Comply with the requirements of NEMA and NEC standards, and applicable portions of NECA's "Standard of Installation", for installation of electrical materials and equipment.

3.04 CUTTING AND PATCHING

A. Cut and patch walls, floors, etc., resulting from the electrical work.

B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Owner's Representative. Impact type equipment will not be used except where specifically acceptable to the Owner's Representative. Openings in precast concrete slabs for conduits, outlet boxes, etc., shall be core drilled to exact size, and only upon the express approval of the Owner's Representative.

C. Openings shall be restored to as new condition under the appropriate specification section for the materials involved and shall match remaining surrounding materials and finishes.

D. Conduit and sleeves, pitch pans, and flashing compatible with the roofing installation shall be provided for roof penetration.

3.05 EXCAVATING FOR ELECTRICAL WORK

A. The work of this article is defined to include whatever excavating and back filling is necessary to install the electrical work. Coordinate the work with other excavating and back filling in the same areas, including dewatering, flood protection provisions, and other temporary facilities. Coordinate the work with other work in the same area, including other underground services, landscape development, paving, and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and back filling. Except as otherwise indicated, comply with the applicable provisions of other sections for electrical work excavating and back filling.

3.06 HOUSEKEEPING PADS

A. Provide housekeeping pads for all floor or ground mounted electrical equipment. Housekeeping pads shall consist of a reinforced concrete pad, at least 4" higher than surrounding floor or grade, extending at least 6" from under equipment mounted thereon. Reinforcing shall be number 3 bars, 12" on centers each way. Interior concrete pads shall be poured integrally with the floor

construction using the same concrete mix. Exterior pads shall be poured monolithically with surrounding equipment and shall additionally include a grade beam of at least 12" deep by 12" wide all around the perimeter of the pad. Pads shall have chamfered edges and shall be trowel finished.

B. Provide housekeeping pads for all conduit stubs from the floor or earth such that conduits are protected at their exit from standing moisture or damage.

3.07 LOCKING OF ELECTRICAL FACILITIES

A. Provide padlocks or lockable latches for electrical facilities subject to unauthorized entry, such as panel boards, transformers, relay cabinets, etc. Key all locks alike. Furnish Owner with two keys per lock up to a quantity of ten keys. Install locks immediately upon installation of electrical facility.

3.08 PAINTING OF ELECTRICAL EQUIPMENT

A. The contractor shall obtain quantities of touch paint from the manufacturers of the various equipment for touch of paint damaged or scratched during construction activity. Paint type and color shall match, and workmanship shall be of the highest order to present a pleasing appearance. Where extensive painting is required or for complete painting, the items shall be factory painted, or if applied by the Contractor, painting shall be performed in accordance with the "Painting" sections of these specifications as applicable to the particular items.

3.09 ELECTRIC METERING

A. Install metering equipment as directed by the local power company, using such equipment as furnished by the local power company, installed in such locations and in the manner directed by the power company, and in accordance with their standards.

END OF SECTION 260501

SECTION 260519 - CABLE, WIRE AND CONNECTORS, 600 VOLT

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. This work comprises the furnishing and installing of cable, wire and connectors as indicated on the drawings and as hereinafter specified.

PART 2. - PRODUCTS

2.01 WIRE

A. Generally, cable, wire and connectors shall be of manufacturer's standard materials, as indicated by published product information. Design and construction shall be as required by the installation.

B. Provide factory fabricated wire of the size, rating, material and type as indicated for each service. Where not indicated, provide proper selection as required to comply with installation requirements and with NEC requirements. The minimum size wire to be used for building power or lighting circuits shall be #12 copper with insulation as noted below. The minimum size wire for outside area lighting shall be #8, including neutrals and grounds.

C. Select from only the following types, materials, conductor configurations, insulation, and coverings:

1. UL Type THW.
2. UL Type THHN.
3. UL Type THWN.

D. Select from the following cable types;

1. SOOW

E. Conductors shall be copper.

1. Conductors - # 10 and 12 AWG shall be solid.
2. Conductors - # 8 and larger; concentric lay stranded, standard flexibility.

2.02 CONNECTORS

A. Provide factory fabricated, metal connectors of the size, rating, material, and types as indicated for each service. Where not indicated, provide proper selection as required to comply with installation requirements and with NEC standards. Select from only the following:

1. For wire sizes up to and including # 6 AWG, use insulated compression type, T & B Sta-con, Burndy Hylug, 3M Scotchlock or equal.
2. For sizes # 4 AWG to 250 MCM, use compression type or bolted type.
3. For 250 MCM and larger, use bolted or compression type. Compression type shall have at least two (2) indents, bolted type shall have at least two (2) bolting elements, spade lugs and pads shall be bolted with a minimum of two (2) bolts, complete with belleville washers.
4. Bolted or compression type connectors shall not be used for more than two (2) conductors, unless specifically approved for such use by UL listing.

5. Gutter tap connectors shall be dual rated connector tee taps with insulating cover Ilsco style GTT or GTA or similar style as required for the function intended.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install electrical cable, wire and connectors as indicated, in accordance with the manufacturers written instructions, the applicable requirements of NEC and the NECA standards, and as required to ensure that products serve the intended function.

B. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.

C. Cables shall be selected on the basis of their purpose and UL listing. Generally, use Types THW, THWN, and THHN in building interiors and other dry locations. Outdoors and underground in raceways, use type RHW or THWN. For direct burial, use type USE. Conductors subject of abrasion, such as in lighting poles, shall be type THWN or THHN.

D. Swab conduits to remove foreign material immediately prior to pulling cable.

E. Pull conductors together where more than one is being installed in a raceway.

F. Use pulling compound or lubricant, when necessary; compound must not deteriorate conductor and insulation.

G. Do not use a pulling means, including fish tape, cable or rope which can damage the raceway.

H. Install exposed cable, parallel and perpendicular to surface or exposed structural members and follow the surface contours, where possible.

I. Install splices and taps which have equivalent or better mechanical strength and insulation as the conductor.

J. Keep conductor splices and taps accessible and to a minimum.

K. Use splice and tap connections which are compatible with the conductor material.

L. Outdoor and underground splices shall be securely waterproofed with vulcanizing tape and overall wrap of Scotch #33 or equal. Heat shrink tubing shall be installed over outdoor and underground splices.

M. **Install cable type SOOW inside all exterior lighting pole locations for conductors from base of pole to fixture connection.**

3.02 TESTING

A. Test feeder circuits, branch circuits in excess of 100-amp breaker or fuse rating, and outdoor power and lighting conductors, including phase and neutrals clear of faults, high resistance connections and megger test same at 600 volts DC. Tests shall be conducted in accordance with the applicable sections of ICEA S-66-524 and NEMA WC7. Test results below one megohm shall be cause for rejection of the wiring installation. Submit test reports to Owner's Representative. Replace and retest all such rejected conductor.

B. Test ground conductors for continuity from end of circuit or device to panel board. Test panel board grounds for continuity to service entrance equipment. Submit test reports to Owner's Representative. Replace and retest all such rejected grounds.

C. Test earth grounds for ground resistance in accordance with applicable standards using an earth ground resistance meter. Earth grounds shall be supplemented with two (2) additional ground rods where earth ground resistance is larger than 25 ohms.

END OF SECTION 260519

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 260526 - GROUNDING

PART 1. - GENERAL

1.01 DESCRIPTION OF THE WORK

A. The extent of the grounding work is indicated on the drawings and schedules, and by the requirements of this section.

B. Provide a specific ground system designed by a third-party engineering design firm specializing in grounding system design based on the soil data, utility company information. System to be in accordance with the City of local jurisdiction of the project standards & the approved edition of the NEC.

C. Service and equipment grounding and bonding shall be in accordance with the National Electric Code and NEMA "Standards of Installation".

D. A **Ufer** type system with a minimum of five types of grounds shall be established in accordance with the NEC between the electrical system grounded conductor and the following.

1. Building domestic water piping.
2. Utility company transformer ground.
3. Any other grounds which may be present in or around the service entrance switchgear.
4. Pole grounds.
5. Building steel.
6. Bonding with reinforcing steel of 20’ lengths encased within concrete.
7. Made grounds and ground mats.
8. Gas piping.
9. Other piping systems.
10. HVAC piping, where direct buried in earth, or in close physical proximity to energized electrical systems.
11. Piping systems associated with other electrical services off premises.

E. Install a separate green wire grounding conductor in all electrical system conduit on this project. Conductor shall be sized in accordance with NEC "Equipment Grounding Conductor" table.

F. Grounds shall be positively made with insulated copper conductor.

G. Verify the existence of a proper grounding system for the existing electrical systems; test for continuity, and repair as necessary.

H. Separately derived systems shall be independently bonded to the building ground system and to premises service entrance electrical system.

I. Provide a #6 copper stranded grounding conductor for telephone, data processing, and other communications systems, complete from building premises ground to respective equipment location, board, or cabinet.

PART 2. - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Except as otherwise indicated, provide grounding system manufacturers' standard materials and components as indicated by their published product information; designed and constructed as required for a complete installation.

B. Wires wrapped around fender washers and screws are not considered adequate for bonding connection. Use UL listed terminal type connectors securely crimped or bolted to wire ends and bolted to cabinets with threaded fasteners and locking washers used solely for bonding purpose.

C. Use stranded copper cable in RMC conduit for ground conductors #6 AWG or larger. Bond both ends of metallic conduit.

D. Grounding connections shall be made with solderless pressure connectors, except copper to steel connections shall be fusion welded Cadweld or equal.

E. All components of the electrical system shall be bonded, including cabinets, junction boxes, cable trays, wire ways, raceways, building steel, etc. in a substantial manner to ensure ground continuity.

F. Install fusion welded ground connectors where they are concealed or inaccessible.

G. Ground each outlet by the use of an approved grounding clip attached to the junction box in such a position to be readily inspected on removal of the cover plate; or by the use of an approved grounding yoke type receptacle. Use grounding clip Steel City Type G or equal.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install ground system as indicated, in accordance with the applicable requirements of the NEC and the NECA "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Install grounding conductors continuous, without splice or connection, between equipment and grounding electrodes.

3.02 LOCATION OF GROUNDS

A. Install a # 3/0 insulated ground wire from the power company transformer to the main service entrance switchgear. If grounding conductor presently exists, (none was observed) and is of NEC size (not neutral conductor) from transformer to main service entrance switch gear, it may be reused after successful test for continuity.

B. Install circuit ground conductors as shown on the Drawings.

C. Provide a ground conductor at each outdoor pole. As an alternate to the ground rod shown on the Drawings, the following installation may be substituted.

D. Install a 20' length of #6 bare solid copper conductor in a ditch which is a minimum of 30" deep and extends radially from the base of each pole. Do not install ground wire in same ditch as circuit conductors. Water in and connect to the system ground at the base of each pole.

E. If a new ground is required at the service entrance, it shall be installed similarly to the pole ground.

END OF SECTION 260526

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 260533 - ELECTRICAL RACEWAYS, BOXES, FITTINGS AND WIRING DEVICES

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules and the requirements of this section.

B. Specification indicates acceptable products, does NOT indicate all the unacceptable products. Products allowed by the NEC or other applicable codes does not warrant acceptable use on this project unless confirmed acceptable in writing by the engineer.

C. The types of electrical raceway systems required for the project may include the following:

1. Rigid metal conduit (RMC).
2. Intermediate metal conduit (IMC).
3. Electrical metallic tubing (EMT).
   a. MC Cable is approved only for use as light fixture whips, and not to exceed 5’ in length.

D. **As additional items Electrical Sub-Contractor shall include in his Base Proposal the following:**

1. **All costs to provide 20 additional duplex electrical outlets for each campus, all required wiring, conduit and devices as directed by Architect-Engineer.**
2. **All costs to provide 10 additional quad electrical outlets for each campus, all required wiring, conduit and devices as directed by Architect-Engineer.**

E. The use of the various raceway systems is restricted to the types and other restrictions of the NEC and the local codes. Use of all such systems shall be verified with the local code authority before use. In the case of questionable or denied use, the contractor shall be required to use a raceway system permitted by the local code at no additional cost.

F. An equipment-grounding conductor shall be installed in all raceways on this project, whether metallic or nonmetallic.

G. Wireways are specifically not permitted, unless shown on drawings. Where wireway is required, it shall be solid, without knockouts, with hinged cover, placed so that cover is gravity closed. Where conductors from two or more feeders or branch circuits are placed in a wireway, the individual conductor sets shall be fireproofed with fiberglass tape or other approved fireproofing method.

H. Install complete, separate conduit systems for all electrical systems on this project to include the following:

1. Medium voltage systems.
2. Service entrance.
3. Control wiring systems.
4. Electrical power and lighting feeders.
5. Electrical power and lighting circuits.
6. HVAC control wiring.
7. Emergency and standby power and lighting circuits.
8. Communication and telephone systems.
9. School administrative communication system.

10. Clock and bell system.
11. Public address, sound, intercom systems.
12. Fire Alarm system.
13. Other electrical systems.

I. The types of electrical boxes and fittings required for the project include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Conduit bodies.
5. Floor boxes.

J. The types of general purpose wiring devices required for the project include the following:

1. Receptacles.
2. Switches.
3. Wall plates.
4. Plugs.
5. Connectors.

PART 2. - PRODUCTS

2.01 CONDUIT MATERIALS AND COMPONENTS

A. For each electrical raceway system indicated, provide a complete assembly of conduit, tubing or duct with fittings including connectors, nipples, couplings, locknuts, bushings, expansion fittings, other components and accessories as needed to form a complete system of the type indicated.

B. Furnish conduit fittings designed and approved for the specific use intended. Furnish conduit fittings with insulated throats or bushings. Furnish rigid conduits with insulated bushings, unless grounding bushings are required. Grounding bushings shall have insulated throats.

C. Metal conduit, tubing and fittings: Provide metal conduit, tubing and fittings of the type, grade, size and weight indicated for each service. Where type and grade are not indicated, provide proper selection to fulfill the wiring requirements, and comply with the NEC for electrical raceways.

1. Rigid hot dipped galvanized steel conduit and fittings (RMC); FS WW-C-581, FS WW-F-408 and ANSI C80.1.
2. Intermediate steel conduit and fittings (IMC); FS WW-C-581E and ANSI C80.4.
3. Electrical metallic tubing and fittings (EMT); FS WW-C-563, FS W-F-408 and ANSI C80.3. Furnish steel compression type EMT fittings with split steel compression ring. Crimp or set screw type fittings are not acceptable.

D. MC (metal-clad cable) will be permitted for box to light fixture connections above lay-in ceilings, and with a maximum length of 6’-0”. MC is not allowed to be installed concealed in walls or used for any other purpose other than light fixture whips. AC (armored cable) is not allowed.

E. Surface metal raceway systems: Surface metal raceway systems shall be UL listed, painted steel, stainless steel, or extruded aluminum as shown or scheduled on the Drawings. Painted color shall be buff or gray as required by the Owners representative during shop drawing review. "W" numbers are Wiremold, "A-T" numbers are Airey-Thompson. Equal equipment by Walker is acceptable. Do not mix systems on the project unless specifically noted or shown.

1. Multioutlet system: Surface metal raceway with simplex outlets spaced 12" on center, or as shown or scheduled on Drawings. Plugmold 2000 or 2100 series, A-T 1100.
2. Raceway system, .26 sq in; A-T 10.
3. Raceway system, .75 sq in; W 2000.
4. Raceway system, 1.10 sq in; A-T 1100.
5. Raceway system, 1.5 sq in; W 2200.
6. Raceway system, 3.3 sq in; A-T 2200.
7. Raceway system, 4.0 sq in; W 3000.
8. Raceway system, 4.8 sq in; A-T 3300.
9. Raceway system, 8.0 sq in; W 4000.
10. Raceway system, 9.0 sq in; A-T 5200D[with single divider].
11. Raceway system, 16.0 sq in; W 6000.

2.02 CABLE TRAY

A. Cable tray shall be ventilated ladder type, roll formed steel, meeting ASTM A446, Grade A, mill pre galvanized in accordance with ASTM A525, coating type G90.

B. Ladder type tray shall consist of two longitudinal members with transverse members welded to the side rails. Rungs shall be spaced 12" on centers.

C. Trays shall have an overall nominal depth of 5" (4" loading). Width shall be as shown or scheduled on Drawings.

D. Fittings shall be minimum 24" radius, or as otherwise shown or scheduled on Drawings.

E. Splice plates shall be the bolted type, using carriage bolts. Resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohm. Splice plates shall be furnished with straight sections and fittings.

F. Cable tray shall be capable of being loaded 80 lbs per foot for 20' spans with 1.5 safety factor.

G. Cable tray shall be B-Line Series 454 or equal.

2.03 OUTLET BOXES, PULL BOXES, JUNCTION BOXES, FABRICATED MATERIALS

A. Provide galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.

B. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.

C. Floor boxes and service fittings: Floor boxes and service fittings shall be flush, concealed service type, UL listed, suitable for simultaneous use for power, communications, data processing, etc. Boxes shall have concealed service top, including carpet and tile floor flange, hinged floor plate and retractable exit. Color gray, dark brown, dark green or medium beige as selected by owners representative on shop drawings.

1. Approved floor boxes are:
   a. Walker – RFB-11 with carpet cover (Where Indicated on Symbol Legend)
   b. Hubbell – Floor Mounted Receptacle, flush, round single service receptacle, stamped steel box, with aluminum adapter ring, and aluminum duplex single service cover.

Model#BA2529, SA3925, SA3182. **Provide with carpet flanges for areas noted on Architect's finish schedule to be located in carpet.**

c. Others approved prior to bidding.

D. Provide cast concrete boxes of the type and size as shown on the Drawings to suit each respective location and installation, constructed of cast reinforced concrete with bolt down cast iron cover marked "ELECTRIC", or as otherwise appropriate. Boxes shall be as manufactured by Brooks Products, Dalworth Quickset or equal.

E. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.

F. Stage & Gym Areas: Equal to Ace Backstage- Full Pocket. Box constructed of 16 gauge steel, welded. With 14 gauge optional welded back box 6" deep, and 11 gauge steel cover, finish as selected by architect during submittal review. Box to feature vertical slant device panel, pre-punch for power, sound system & theatrical devices noted to occupy box. Coordination between trades is required prior to ordering box.

2.04 WIRING DEVICES

A. Provide factory fabricated wiring devices of the type and electrical rating for the service indicated. Where type and grade are not indicated, provide proper selection to fulfill the wiring requirements**. Wiring devices include receptacles and switches shall be ivory in color with stainless steel cover plates**. Special purpose outlets shall be of appropriate color.

B. Furnish receptacles, which comply, to NEMA Standards, Publication No. WD1 and in accordance with the following. Manufacturer and Catalog numbers used are Leviton Mfg. unless otherwise noted. Approved equals are Cooper, and Hubbell.

1. Industrial specification grade duplex receptacles: Leviton 5262 series; 20A, 125V NEMA 5-20R: Leviton 5362.
2. Hospital Grade duplex receptacles: 20A, 125V NEMA 5-20R: Leviton 8300 series.
3. Duplex Receptacles, Decora Plus industrial specification grade: 20A, 125 V NEMA 5-20R: Leviton 16352 series.
4. Hospital grade duplex receptacles, Decora Plus: 20A, 125V NEMA 5-20R: Leviton 16362-HG series.
5. Transient voltage surge suppression type duplex outlet with isolated ground, 20A 120 v; Leviton 5380.
6. Isolated ground type duplex outlet shall be Hospital Grade, 20A 120 v; Leviton 5362-IG.
7. Weatherproof Outlets, 15A, 125V: Leviton 6599 ground fault circuit interrupting with Leviton 5977-DCL while-in-use cover. Do not use feed through feature. Install separate GFCI device at each location.
8. Single Outlets, Industrial specification grade 20A, 250V, NEMA 6-20R: Leviton 5461 with 5466-C plug.
9. Cord Plugs and Connectors: Furnish plugs and connectors which comply with NEMA Standards Publication No. WD1.
10. Safety Outlet (Tamper resistant) Hospital Grade, 15A, 125 V: Leviton 5262-SG, color as selected by Architect / Engineer. Floating Shutters clear access to energized contacts.
11. Clock receptacles, single receptacle outlet, commercial specification grade with recessed clock-hanger, 20A, 125V: Leviton T5361-CH.
12. Special purpose receptacles shall be Leviton Industrial specification grade, of the NEMA configuration as scheduled, complete with matching rated plug, installed on the appliance if the appliance is present; or turned over to the Owner for his use if no appliance is present.

C. Switches: Furnish AC switches which comply with NEMA Standards Publication No. WD1 and in accordance with the following. Special purpose switches shall be of appropriate color. Manufacturer and catalog numbers shown are Leviton unless otherwise noted. Approved equals are Cooper, and Hubbell. Switches shall be rated for 120-277 volt AC, number of poles as required.

1. Standard switch, Industrial specification grade AC Quiet Switches:
   a. 20A single pole: 1221-2
   b. 20A double pole: 1222-2
   c. 20A three way: 1223-2
   d. 20A four way: 1224-2
2. Decora Plus Commercial specification grade switch: 20A; Leviton 5621-2 series.
3. Locking Switch: 120 - 277V shall be manufactured by P & S
   a. **Single Pole – PSAC1-WL**
   b. **Three Way – PSAC3-WL**
4. Key Lock Power Switch: 20A, 120 – 277V, Industrial specification grade, provided with 2 master keys per switch.
   a. **Single Pole – Leviton 1221-2KL**
   b. **Three Way – Leviton 1223-2KL**
5. Infrared wall switch, 800W incandescent / 1200VA fluorescent, 120 v; 2700VA fluorescent 277V, 1/4 hp @ 120V AC; Leviton ODS10-ID or equal.
6. Door switch: Leviton 1865
7. Switch with red pilot light: 120 - 277V, 15A: Leviton 1201-PLR; 20A: Leviton 1221-PLR.
8. Weatherproof switch cover, P&S WP-1.
9. Motor Rated Switch: 120 or 277 V, single pole, 15A, Leviton 1281; 20A, Leviton 1285; 30A Leviton 1287, in NEMA I enclosure or flush mounted. Use equivalent devices for 2 or 3 pole requirements.
10. Switch terminal screws or connectors shall be designed to accommodate and firmly terminate up to No. 10 solid conductors.
11. Use 15 ampere switches, except as follows: 20 ampere switches for loads in excess of 1200 volt amperes at 120 volts and in excess of 2,700 watts at 277 volts. Use HP rated switches approved for motor control or disconnect service when controlling or disconnecting motor loads in excess of 1/3 HP.

D. Wall Box Dimmer Switches shall be 120V, with off-on switch to permit preset level, slider type control, gangable, color to match wall switches, **Lutron Nova T Series installed per manufacturer's instructions to provide minimum wattage as designed**. Use Decora style plates as required.

E. Relays, if any, shall be multipole mechanically held 30 ampere, 120V operating coil, 600V contacts, and auxiliary contacts as required for 2-wire operation, coil clearing contacts; Zenith ESS Series or equal.

F. Time Clocks, if any, shall be seven day with spring wound carry over, maintained contact, 4PST, 4NO, Paragon #7217-00 or momentary contact 2NO, 1NC, Paragon #77211-00 or equal as required by desired function and schedules.

G. Contactors, if any, shall be multipole mechanically held, rated for tungsten or inductive load contact rating, 120V operating coil, 600V contacts, ampere rating as scheduled or required; auxiliary contacts, relays, coil clearing contacts, etc., as required for specified function.

H. Door Buzzer System:

1. Weatherproof Push Button: Flush mount, Normally open contacts, flush weatherproof push button features with a weatherproof diaphragm enclosing the mechanism, wall plate with

rubber gasket for weather tight integrity. **Edwards Model 852.**

2. Indoor Signal Buzzer: Vibrating Armature, Universal Adaptaplate for mounting directly on surface or electrical box, Plug-in convenience, Corrosion resistant heat flowed epoxy finish, adjustable volume. Provide universal Adaptaplate for mounting directly on any single-gang box or 4" octagon box. **Edwards Model 340A-R5.**

2.05 WIRING DEVICE ACCESSORIES

A. Wall Plates: Provide switch, duplex outlet, and telephone, and special purpose wall plates for wiring devices, with ganging and cutouts as indicated, provided with metal screws for securing plates to devices, screw heads colored to match finish of plate. Wall plates shall possess the following additional construction features:

B. Material and Finish: Satin finished stainless steel, 0.19” thick, type 302, equal to Leviton 84001-40 series.

C. Provide oversize plates where required to completely cover wall opening. Where oversize plates are used, all plates in room shall be oversize style, Leviton Midway size.

D. Use #1614 or #1622 plates and Raco narrow gang boxes in storefront mullions and where narrow boxes are required.

PART 3. - EXECUTION

3.01 INSTALLATION - CONDUITS, GENERAL

A. Install conduit and tubing products as indicated, in accordance with applicable requirements of NEC and the NECA "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Unless otherwise specified for special systems, install conduit wiring system complete from point of origin to outlets shown. Wiring systems shall be complete with offsets, pull boxes, junction boxes, and fittings as required for a harmonious routing of the system.

C. Take all necessary precautions to prevent the occurrence of electrolytic corrosion between dissimilar metals. Dissimilar metals, where subject to moisture or condensation, shall be joined with insulated couplings, properly jumpered for ground continuity.

D. Where conduit penetrates concrete slabs or floors, provide a 2" high curb extending 2" from the outer surface of the conduit penetrating the floor to prevent corrosion. Terminate conduit stub ups in couplings slightly above the finished concrete curb. Paint the stub up with Scotch Clad Protective Coating # 1706 or equal a minimum of 6" above and below the finished surface of the concrete.

E. Install 50 pound nylon pull cord in empty raceways.

F. Complete electrical raceway installation before starting the installation of conductors.

G. Cap open ends of raceways until conductors are installed.

H. Size conduits in accordance with NEC conduit fill requirements unless otherwise indicated on the drawings. Minimum conduit size shall be 3/4" trade size.

I. Wherever possible and unless otherwise indicated on the drawings, install conduit concealed in walls, partitions and above the ceiling. Install conduit exposed in ceiling area at the structure in electrical rooms, mechanical rooms and other rooms where ceilings are not present or scheduled.

J. In mechanical rooms install conduit to equipment not adjacent to walls, by dropping conduits exposed from overhead.

K. Install conduit in slabs only when indicated on drawings, above waterproofing and in such a manner so as not to damage the integrity of the concrete.

L. Install RMC or IMC at all locations with the following exceptions permitted.

1. EMT may be used where conduits are 2" or smaller and are not subject to damage as follows:
   a. Exposed inside building, 18" above the floor
   b. In dry walls.
   c. In masonry walls.
   d. Above ceilings.
2. Install liquid tight flexible metal conduit (LTM) for connections to rotating, vibrating, moving or movable equipment. Install external ground wire on flexible conduit with grounding bushings. PVC liquid tight flexible conduit (LTP) is permitted where permitted by the Local Code.

M. Exterior conduits: Install conduits outside of building lines at a minimum depth of 36" below finished grade or as otherwise shown or scheduled on the Drawings. Maintain 12" earth or 2" concrete separation between electrical conduits and other services or utilities underground. Concrete encasement will not be required except as specifically detailed or noted on drawings.

N. Service entrance conduits shall be RMC unless otherwise indicated on the drawings.

O. Install conduits parallel and supported on Unistrut or equal trapezes and anchored with split ring hangers, conduit straps or other devices specifically designed for the purpose. Wire ties are not permitted. Fasten conduit with the following materials.

1. Wood screws on wood.
2. Toggle bolts on hollow masonry.
3. Bolts and expansion anchors in concrete or brick.
4. Machine screws, threaded rods and clamps on steel.
5. Conduit clips on steel joints.

P. Install underground conduits with sealing glands equal to OZ Type FSK exterior to the conduit and OZ Type CSB, or equal internally at the point where conduits enter the building to prevent water seepage into the building.

3.02 INSTALLATION OF BOXES AND FITTINGS

A. Install insulated bushings on conduits entering boxes or cabinets, except threaded hub. Provide locknuts on both inside and outside of enclosure for grounding. Bushings shall not be used in lieu of locknuts.

B. Install watertight seals and bushings where conduit and wire enter boxes, equipment, buildings, or fixtures.

C. Install electrical boxes and fittings in compliance with NEC requirements and in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes and fittings serve the intended purposes.

D. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

E. Provide knock out closures to cap unused knock out holes where knock out holes have been removed.

F. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

G. Round boxes, where conduit enters through the side of the box are not permitted.

H. Secure boxes rigidly to the substrate upon which they are being mounted. Solidly embed boxes in concrete or masonry. Boxes shall not be permitted to move laterally, or to be supported only by EMT.

I. Install outlets flush with finished walls or ceiling surfaces for concealed wiring.

J. Install blank cover plates, painted to match surroundings, at pull boxes, junction boxes and all others to which no fixture or device is to be attached.

K. Use masonry type boxes with square corners in unplastered tile walls to allow tile to be sawed out neatly around box. Plates shall cover any cracks between box and tile. Use oversize plates where necessary.

L. Outlet boxes shall be flush mounted in walls and of suitable depth to contain the particular apparatus involved.

M. Use shallow type outlet boxes installed flush in plaster partitions. There shall be at least e" plaster covering on back of box.

N. Protect boxes in such a manner as to prevent foreign material such as plaster from entering boxes. Boxes shall be thoroughly cleaned of foreign materials before pulling conductors.

O. Locate exposed pull or junction boxes subject to the owner's representative’s approval.

P. Install approved 3/8” fixture studs in outlets from which lights are suspended, fastened through from back of box. Anchor outlet boxes and particularly those supporting fixtures, securely in place in an approved manner. Support outlet boxes and fixtures from building structures, not from ceiling materials. Provide yokes, channels, studs or other supporting materials as required.

Q. Coordinate all lighting fixture outlets with mechanical and architectural equipment and elements to eliminate conflicts and provide a workable neat installation.

R. Where more than one switch occurs at the same location, use multiple gang outlet boxes covered by a single plate.

S. Separate switches ganged in one box by a grounded metal barrier where system voltage exceeds 150 volts to ground.

T. Fittings shall be approved for grounding purposes or shall be jumpered with a copper grounding conductor of appropriate ampacity. Leave terminations of such jumpers exposed.

U. Install expansion fittings in conduit as follows.

1. Conduit crossing building expansion joints.
2. Conduit straight runs in excess of 100'.
3. Locations subject to thermal expansion and as otherwise required by the NEC.
4. Expansion fittings are not required where offsets, expansion loops, or flexible conduit are placed in conduit runs.

3.03 LOCATION OF BOXES AND DEVICES

A. The approximate location of switches, light outlets, power outlets, etc. is indicated on the plans. These drawings, however, may not give complete and accurate information in regard to locations of such items. The exact locations shall be determined by reference to the general building plans and by actual measurements during construction of the building, subject to the owner's representative's approval.

B. The owner's representative reserves the right to make reasonable changes in the indicated locations before work is roughed in without additional charge.

C. Unless otherwise shown or specified, install wall switches 42" above finished floor. Verify all door swings with the Architectural Drawings and schedules and locate switches and pull stations, unless specifically noted otherwise, on the strike side of the door. If switch is indicated on hinged side of door, verify location with the Owners Representative.

D. Where shown near doors, install wall switches not less than 2" and not more than 12" from trim. Drawings are diagrammatic; switches shall be ganged in multiples as required covered by a single multigang cover plate. Where convenience outlets, telephone outlets, or data processing equipment outlets are near each other, outlet boxes shall be joined or otherwise placed so that they are all the same level. Device plates shall match for all outlets.

E. Install convenience outlets and telephone outlets 18" from floor, or as otherwise noted on the drawings. Receptacles at cabinets shall be placed directly above, and not in, the back splash, and shall be mounted horizontally. Coordinate placement of such outlets with the cabinetry. Install convenience outlets for fixed appliances, such as electric water coolers, at heights and locations as required by the application and in accordance with the appliance manufacturer's recommendations and requirements.
Verify mounting heights of outlets indicated on the drawings with the owner's representative prior to installation. If the various heights are not verified, the owner may require that they be relocated; such relocation shall be at the sole expense of the contractor.

END OF SECTION 260533

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 260534 - PULL AND JUNCTION BOXES

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. This section describes general provisions, products and methods of execution relating to pull and junction boxes approved for use at ANC. Furnish all such boxes required to conform to requirements for maximum pulling length and maximum number of bends allowed.

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of equipment of this type whose products of this type have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with Work similar to that required for this project.

C. Pull and junction boxes 50 cubic inches and smaller shall conform to specifications for outlet boxes, Section 16140.

D. Pull and junction boxes larger than 50 cubic inches shall conform to UL Standard 50-1970, Cabinets and Boxes. The UL label shall constitute proof of acceptable quality.

1.03 SUBMITTAL

A. Submit data indicated in Section: GENERAL REQUIREMENTS, MECHANICAL.

B. Submit list of all products incorporated into the Work.

C. Submit the following Product Data, Shop Drawings, and Samples.

Item	Prod Data	Shop Dwgs	Sam-ples
Concrete pull boxes	X	X	
Fibergalss pull boxes	X	X	
Steel pull boxes	X	X	
Box enclosres	X	X	
Box covers	X	X	

D. Include manufacturer's instructions for each product with submittal.

E. Submit reports and other documents as required.

PART 2. - PRODUCTS

2.01 INDOOR PULL AND JUNCTION BOXES

A. Hazard Markers for Pipe-Conveyed Material:

1. Indoor pull and junction boxes shall conform to Article 370 of the NEC and the following requirements:
   a. Sheet metal boxes are approved for use in all dry, interior, non-hazardous locations.

b. Boxes installed in wet locations shall be NEMA 4.
c. Special boxes as required by the application shall be installed in areas of specific service and/or hazards.
d. Junction box extension rings will not be accepted on new boxes. Appropriate size boxes shall be used for each application.

B. TELECOMMUNICATION SYSTEM PULL BOXES

1. Telecommunication system Pull Boxes shall also conform to the latest editions of ANSI/EIA/TIA 569 and the BICSI Telecommunications Distribution Methods (TDM) Manual.
2. Dimensions:
   a. Pull boxes for straight through pulls shall have minimum interior dimensions in accordance with the following Table:

Maximum Trade Size Conduit	Size of Box			For Each Additional Conduit Increase Width
Width (inches)	Length (inches)	Depth (inches)		
1 Inch	4	16	3	2inches
1 *1/4* Inch	6	20	3	3 inches
1 *1/2* Inch	8	27	4	4 inches
2 Inch	8	36	4	5 inches
2 *1/2* Inch	10	42	5	6 inches
3 Inch	12	48	5	6 inches
3 *1/2* Inch	12	54	6	6 inches
4 Inch	15	60	8	8 inches

C. UNDERGROUND PULL BOXES

1. Boxes set in ground shall be either pre-cast concrete or cast iron. Covers shall be galvanized steel or cast iron, and shall be bonded to the grounding system with a stranded grounding conductor secured with a grounding lug. Provide sufficient slack to allow removal of the cover and normal working access.

D. OUTDOOR ABOVE-GROUND PULL AND JUNCTION BOXES

1. Boxes exposed to rain or installed in wet locations shall be NEMA 4.

2. Outdoor pull and junction boxes and conduit bodies for use with galvanized conduits shall be made of galvanized ferrous metal or cast aluminum, with integral threaded hubs or Myers-type weathertight hubs of matching composition and finish.
3. Outdoor pull and junction boxes for use with PVC or plastic-coated conduits shall be made of fiberglass, with matching gasketed covers secured with captive monel or stainless steel screws; Hoffman A-JFG series or accepted equal. Each metallic conduit entry (including liquidtight flex) shall be provided with a bronze bond bushing and NEC-sized copper bonding jumper inside the enclosure.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Junction and pull boxes shall be installed so that covers are readily accessible and adequate working clearance is maintained after completion of the installation.

B. Select boxes properly sized per NEC for power and lighting applications.

3.02 TELECOMMUNICATIONS SYSTEM PULL BOXES

1. Where a pull box is required in a 1 inch conduit run, outlet boxes as specified in Section 260533 - Outlet Boxes may be used. Where a pull box is required in a conduit run **1** *1/4* inch or larger, or where required for multiple raceways, the box shall be sized in accordance with the Table in this Section.
2. Pull boxes shall be located in straight-through sections of horizontal cabling pathways (conduits). Pull boxes shall not be used for angle pulls or to accomplish changes in direction of the pathway.
3. Multiple raceways connecting to telecommunications system pull boxes shall penetrate box walls such that they are distributed evenly along the Box wall.

3.03 TELECOMMUNICATIONS SYSTEM JUNCTION BOXES

1. Junction boxes shall not be used in interior horizontal pathway conduits or interior backbone pathway conduits unless specifically allowed by ANC. Where specifically allowed, junction boxes shall be located in a readily accessible location. Junction boxes shall not be located in above ceiling spaces unless specifically allowed by ANC.
2. Junction boxes for telecommunication shall be hinged covered cabinets, sized in accordance with the requirements of ANSI/EIAJTIA-569.
3. Junction cabinets shall have a fire-treated plywood backboard suitable for mounting punch down style terminal blocks, in accordance with data & telephone specifications.

END OF SECTION 260534

SECTION 260535 - ELECTRICAL CONNECTIONS TO EQUIPMENT

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of electrical connections to equipment is indicated on the drawings and in schedules, in other Divisions of the specifications, and by the requirements of this section, and is hereby defined to include connections for providing electrical power to equipment.

B. The types of electrical connections specified in this section include, but are not necessarily limited to the following:

1. To water heaters.
2. To motors.
3. To electric heaters.
4. To motor starters.
5. From motor starters to motors.
6. To HVAC equipment. **(Coordinate and provide Voltage and Power requirements, including possible neutrals depending on manufacturer, with Mechanical Contractor)**.
7. To HVAC control and other control devices.
8. To Owner furnished equipment.

PART 2. - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. For each electrical connection indicated, provide a complete assembly of materials, including but not necessarily limited to the following:

1. Pressure connectors.
2. Terminals.
3. Electrical insulating tape.
4. Heat shrinkable tubing.
5. Cable ties.
6. Solderless wire nuts.
7. Conductors.

B. Furnish materials and components in compliance with equipment manufacturer's recommendations for the intended application.

PART 3. - EXECUTION

3.01 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated, in accordance with applicable portions of the National Electrical Contractor's Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended functions.

B. Connect electrical power supply conductors to equipment conductors in accordance with to other sections of the specifications and in accordance with equipment manufacturer's written

instructions and wiring diagrams. Wherever possible, match conductors of the electrical connection for proper interface between the electrical supply and the installed equipment.

C. Cover splices with electrical insulation equivalent to, or of a higher rating, than insulation of the conductors being spliced.

1. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure a uniform and neat appearance where cables and wires are terminated.
2. Trim cables and wires to be as short as practicable allowing adequate slack for future disconnection and reconnection. Arrange routing to facilitate inspection, testing and maintenance.
3. Provide conduit for connections in accordance with other sections of the specifications.
4. Coordinate installation of electrical connections to the equipment with equipment installation work and as follows:
    a. Make electrical connections to equipment furnished under other sections of the Contract Documents.
    b. Furnish wiring, conduit, outlet boxes; disconnect switches, etc., as required for same throughout the project.
    c. Check the General Construction, Mechanical, and other drawings and specifications and determine the amount of required wiring for final connections.
    d. Verify locations, horsepower, voltages, etc., of all such equipment as the work progresses.
    e. Advise the Owner's Representative immediately, for clarification, if an apparent conflict arises in control wiring, power wiring, etc.

D. Due to manufacturer's changes or substitutions, equipment furnished under the mechanical and other sections of the specifications may require different rough in requirements than indicated on the plans. Secure detailed drawings from the Contractor furnishing the equipment, to determine actual rough in locations, and conduit and conductor requirements to assure a proper and workmanlike installation.

E. Install motor controls, safety switches, etc. for all equipment on new :" thick fire resistant plywood with two (2) coats of paint to match surrounding area. Arrange all equipment in each area to mount on one piece of plywood where possible.

F. Install safety switches on unitary equipment, adjacent to conduit entry, and in such a manner as to not interfere with the operation of, or access to the equipment. Disconnect and safety switches shall not be mounted on the building exterior wall, but shall be mounted upon the equipment being served, convenient to the equipment power connection terminals, and observing Code clearance requirements.

G. Wireways are specifically not permitted unless shown on Drawings.

3.02 FINAL CONNECTIONS FROM MOTOR STARTERS TO MOTORS

A. Furnish and install conduit, wiring, disconnects, etc., as required to install final connections from motor starters to motors. Verify number and size of conductors, and disconnecting means requirements. Part winding, and wye-delta starting, as well as multi-speed motors may require multiple or 6-pole disconnects which shall be furnished and installed under this section of the Contract Documents, whether or not specifically called for on the drawings.

END OF SECTION 260535

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1. - GENERAL

1.01 SCOPE OF WORK

A. The extent of the electrical system and equipment requiring identification is shown on the drawings, and the extent of identification required is specified herein and in individual sections of work requiring identification.

B. The types of electrical identification specified in this section include the following:

1. Buried cable warnings.
2. Conductor color coding.
3. Operational instructions and warnings.
4. Danger signs.
5. Equipment/system identification signs.

PART 2. - PRODUCTS

2.01 IDENTIFICATION MATERIALS

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, engraved with engraver's standard letter style unless otherwise indicated. Plastic laminate shall be 1/16" thick up to 20 square inches and 1/8" for larger size. Letters shall be 3" high, black on white background.

B. Color-coded plastic tapes shall be self-adhesive vinyl tape not less than 2" wide and not less than 3 mils thick. Color as specified.

C. Brass Disks used for feeder identification shall be No. 16GA 2" Brass Disks, with stainless steel tie wire. Letters/Numbers shall be punched into disks, size 2" letters.

2.02 LETTERING AND GRAPHICS

A. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as required for proper identification, operation and maintenance of the electrical systems and equipment.

PART 3. - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. Where identification is to be applied to surfaces which require finish, install identification after completion of finishing.

3.02 CONDUCTOR COLOR CODING

A. Conductor’s #8 and smaller: Insulation continuously colored throughout.

B. Conductors larger than #8: Three (3) continuous wraps of 2" wide 3M #191 tape at each end and at pull and junction boxes, and where splices occur.

C. 120/208 volt, 3-phase, 4-wire system:

1. Phase A - Black.
2. Phase B - Red.
3. Phase C - Blue.
4. Neutral - White.
5. Ground - Bare or Green.
6. Switch legs shall be – Purple
7. Travelers shall be - Pink

D. 277/480 volt, 3-phase, 4-wire system:

1. Phase A - Brown.
2. Phase B - Orange
3. Phase C - Yellow.
4. Neutral - Gray.
5. Ground - Bare or Green.
6. Switch legs shall be – Purple
7. Travelers shall be - Pink

E. Control and special systems, 600 volt and less, #14 and larger:

1. Any color other than green and white.
2. Include tracer color for identification.
3. Keep colors selected continuous throughout the project.
4. Isolated systems, as required by NEC Sec 517.

F. All switch legs and travelers shall be marked with phase tape. Tape shall correspond to phase color coding.

1. I.E. Switch legs and travelers for light fixtures served by Phase A on a 277 volt system shall be marked with brown phase tape to comply with NEC 210, 4, D.

G. Each fixture whip will need to be marked at all accessible locations in the same manner as the corresponding switch legs and travelers.

3.03 EQUIPMENT/SYSTEM IDENTIFICATION SIGNS.

A. Identify with engraved laminated nameplates, designating load served, on each electrical item on the project. Items to be identified and location of nameplates are as follows:

1. Each circuit breaker in distribution panel -- adjacent to each circuit breaker.
2. Spares shall be labeled "Spare".
3. Each lighting panel -- on panel trim cover immediately above panel door.
4. Each dry type transformer -- directly above nameplate and connection diagram.
5. Each safety switch -- on outside of cover.
6. Each relay cabinet -- on outside of cover.
7. Each time clock -- on outside of cover.
8. Each exhaust fan switch -- custom engraved on outside of switch cover plate.
9. Each motor starter -- on outside of cover.
10. Any switch for load that cannot be seen from the control point -- custom engraved on outside of switch cover plate.

B. Nameplates shall be securely attached with an approved mechanical fastener. Adhesive attachment shall not be permitted.

C. Feeder identification tags shall be attached to each feeder at each point of entry into junction boxes, equipment, at wall penetrations and at intervals not exceeding 100' along run of cable.

END OF SECTION 260553

SECTION 260573 - ELECTRICAL EQUIPMENT ACCEPTANCE TESTING AND START-UP

PART 1. - GENERAL

1.01 SCOPE

A. The Contractor shall engage the acceptance testing and startup services of the field engineering service division of a major electrical distribution equipment manufacturer which maintains division-wide recognized specialized testing capabilities for the purpose of performing tests as herein specified.

1.02 RELATED SECTIONS

A. Section 262400 – Switchboards, Panels, & Enclosures

B. Section 262405 – Integrated Facilities Switchboards

1.03 Applicable codes, standards and references

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

1. National Electrical Manufacturer's Association – NEMA
2. American National Standards Institute – ANSI
3. Institute of Electrical and Electronic Engineers – IEEE
4. National Electrical Code – NEC
5. National Fire Protection Association – NFPA
6. American Society for Testing and Materials – ASTM
7. Insulated Power Cable Engineers Association – IPCEA
8. Association of Edison Illuminating Companies – AEIC
9. Occupational Safety and Health Administration – OSHA
10. State and local codes and ordinances
11. Applicable Independent Testing Associations Specifications

B. All inspections and tests shall utilize the following references:

1. Project design specifications
2. Project design drawings
3. Manufacturer's instruction manuals applicable to each particular apparatus.

1.04 QUALIFICATIONS of testing company

A. The testing plan and procedures shall be reviewed and approved by one of the field engineering division's registered professional electrical engineers. The registered professional engineer shall be a full time employee of the engineering service testing group with at least 10 years of field experience testing electrical apparatus.

B. The engineering service testing group shall be an independent division of a major electrical equipment manufacturer.

C. The engineering service division site lead engineer or project manager shall be a degreed engineer, who is a full-time employee, with at least 10 years of experience testing electrical apparatus, and has obtained factory training. All other employees working on this project shall have had specific factory, and/or field training in accordance with division-wide standards.

D. To ensure compliance with standard quality control standards, the engineering service division shall conduct periodic audits of test procedures and test record forms to ensure compliance with consistent standards. In accordance with standard Quality Assurance practices, a Quality Assurance Manager, not reporting to the operation center completing the field testing services, must complete such audits. The name of the Quality Assurance Manager, or separate audit agency, shall be submitted for approval prior to award of any contract or completion of any fieldwork.

E. All test records shall be recorded onto standardized test forms. All data shall be uploaded to a central computer in a data-secured environment; therefore ensuring no changes can be incorporated into the final test records. These records shall be retrievable for a period of not less than five years, based on a mutually agreed periodic maintenance plan, separate from this contract.

F. Should repairs be required, the engineering service division shall maintain dedicated locations that perform remanufacturing and reconditioning of electrical equipment. All repairs shall be conducted under the direction of a quality control and reconditioning standard pursuant to ISO9001 compliance. A quality certificate, computer database and final test records shall document the progress of each piece of electrical equipment through the repair or reconditioning process. All work is to be performed to a consistent national standard. Documentation of periodic audits, as specified in item D above, shall also be maintained for the dedicated remanufacturing and reconditioning facility.

G. The engineering service testing group shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.

H. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain.

I. Instruments shall be calibrated in accordance with the following frequency schedule:

1. Field instruments – six to twelve months
2. Laboratory instruments – twelve months

J. Dated calibration labels shall be visible on all test equipment.

K. Records must be kept up to date, which show date and results of all instruments calibrated or tested.

L. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.

1.05 SUBMITTALS

A. The test report shall include the following:

1. Summary of project
2. Description of equipment tested
3. Description of test
4. Test results
5. Conclusions and recommendations
6. Appendix, including appropriate test forms
7. List of test equipment used and calibration date
8. Conditions for future access to secured computer database of all Test Data.

B. Furnish three copies of the completed report to the project engineer no later than 30 days after

completion of the project, unless directed otherwise.

1.06 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act of 1970 – OSHA 29CFR 1910.269
2. National Fire Protection Association – NFPA 70E
3. Applicable state and local safety operating procedures.

B. All tests shall be performed with apparatus de-energized except where otherwise specified.

C. The engineering service testing group's lead test engineer for the project shall be a designated safety representative and shall be present on the project and supervise testing operations and safety requirements.

D. Power circuits shall have conductors shorted to ground by a hotline grounded device approved for the purpose in accordance with the appropriate test procedures.

E. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so.

F. The engineering service testing group shall have available sufficient protective barriers and warning signs, where necessary, to conduct specified tests safely.

G. The owner's safety procedures shall be reviewed and understood by the engineering service testing group personnel.

PART 2. - PRODUCTS

2.01 EQUIPMENT EVALUATION PREPARATION

A. The electrical contractor shall torque down all accessible bolts; continuity checks on all branch and control wiring; and rotational tests for all distribution and utilization equipment prior to and in addition to tests performed by the engineering service testing group, specified herein. Contractor shall remove metal shavings and thoroughly clean and vacuum equipment before testing or energizing.

B. The electrical contractor shall supply a suitable and stable source of test power for testing at each test site. The engineering service testing group shall specify requirements.

C. The electrical contractor shall notify the engineering service testing group when equipment becomes available for electrical tests. Work shall be coordinated to expedite project scheduling.

D. The customer designated project engineer or consultant will supply a complete set of as-built electrical plans, specifications and any pertinent change orders to the engineering service testing group prior to commencement of testing.

E. The engineering service testing group shall notify the project engineer prior to commencement of any testing.

F. The engineering service testing group shall be responsible for implementing all final settings and adjustments on protective devices and electrical equipment in accordance with the project

engineer's specified values. Final settings and adjustments shall be provided to the engineering service testing group, by the project engineer, unless an electrical system analysis was performed by the engineering service testing group, in advance of scheduled start-up and acceptance testing.

G. Any system, material or workmanship which is found defective on the basis of electrical tests shall be reported directly to the project engineer.

H. The engineering service testing group shall maintain a written record of all tests and upon completion of the project, assemble and certify a final test report.

PART 3. - EXECUTION

3.01 FIELD TESTING

A. The field engineering service testing group shall provide all material, equipment, labor and technical supervision to perform such tests and inspections. The field engineering service division of the equipment manufacturer shall administer all acceptance and start-up testing, and power system studies, as referenced in other specification sections.

B. It has been identified that costs & downtime may be associated with improper start-up by groups that are not factory trained. Therefore following the completion of all power system studies, including pf capacitor & breaker setting, acceptance testing and start-up by the field engineering service division of the equipment manufacturer, a 2-Year warranty will be provided on all inspected & tested components manufactured by the engineering service parent manufacturing company.

C. The intent of these tests is to assure that all electrical equipment is operational within industry standards and manufacturer's tolerances and that equipment is installed and functioning in the system in the manner designed by the engineer.

D. Upon completion of the tests and inspections noted in these specifications, a label shall be attached to all serviced devices. These labels will indicate date serviced and the engineering service testing group responsible.

E. The tests and inspections shall determine suitability for initial continued reliable operation.

3.02 SWITCHBOARD ACCEPTANCE TESTING FOR MAIN SWITCHBOARD(S)

A. Examine the Main switchboard(s), including breakers, and accessories for:

1. Doors, panels, and sections for alignment, dents, scratches, fit, and missing hardware
2. Shipped loose and shipped short components.
3. Shipping damage
4. Loose or obviously damaged components.
5. Proper identification.
6. Physical damage from installation.
7. If the unit was placed in temporary storage, verify and record that proper procedures were observed. Remove temporary heater wiring and shipping braces.

B. Inspect

1. Shipping Splits to insure that all bus connections were properly connected and all control wiring splits have been properly terminated.

2. Inspect all grounding connections for cleanliness and alignment.
3. Main Bonding Jumper for proper size and termination (Refer to NEC Article 250, Section 250-102, Equipment Bonding Jumpers).
4. Insulators for evidence of physical damage or contaminated surfaces.
5. Surge Arrester and/or Surge Suppression size, type, installation and connection to determine if they are in accordance with the drawings (Refer to NEC Article 280)
6. Control power & instrument transformers, if applicable.
7. Wiring for damaged insulation, broken leads, tightness of connections, proper crimping, and overall general condition.

C. Verify structure, grounding, cables and bus assembly:

1. Anchorage (per local codes, wind and seismic considerations).
2. Required area clearances, correct alignment and cleanliness.
3. Verify the grounding electrode conductor is properly sized (in accordance with NEC Article 250, Table 250-66) and terminated.
4. The proper grounding of instruments, panels and connections (Refer to NEC Article 250, Part J, Sections 250-170 through 250-178).
5. That conductors are properly identified (as applicable).
6. Cable termination tightness.
7. That all cables have been properly installed routed and supported and are clear of energized parts.
8. That conduits and conduit bushings are correctly installed.
9. Tightness of accessible bolted electrical connections, especially shipping splits, by calibrated torque-wrench method in accordance with manufacturers published data.
10. Verify Control & Instrumentation:
    a. That all VT and CT ratios properly correspond to drawings and that polarity is correct.
    b. That shorting screws and bars are removed from CT's and terminal blocks as required.
    c. That primary and secondary fuse ratings or circuit breakers match drawings.
    d. Meter scaling and type match drawings.

D. Set Meter, Relay, & Breaker Trip settings

1. The meter, protective relay, breaker settings (& PFC choices) must be supplied from a Power System Study performed by the engineer service group prior to commissioning.
2. Calculations and settings are to take into account coordination and protection that might be non-intuitive. i.e. a 5000 amp breaker may be set to a 3000 amp trip point to match a utility primary fuse. While this may not seem right at first, tripping the main first rather than a normally smaller utility transformer may avoid blowing a primary utility fuse, and avoid the resulting single phasing and the downtime of waiting for the utility response. It would be far simpler and faster to reset main and reenergize quickly, not to mention the loss of equipment from single phasing.
3. Set meter, relay, & breaker trip setting per above study.

E. Ductor Testing

1. Inspect shipping splits for mechanical connection assuring adequate surface contact.
2. Ground bonding & shipping splits shall be tested with ductor tester (Digital low ohm resistance meter) to insure connection is a low resistance connection. Test from one fixed bus to adjacent fixed bus through the shipping split connector to measure both connection points.
3. Microhm values shall not vary more than 50% from other phase readings and meet the manufactures published data based on bus size, ampacities and material.

F. Test of the phase loss & under voltage relay

1. Test the phase loss relay, either separate or integral to the multimeter, to activate contact.
2. Test the under voltage relay, either separate or integral to the multimeter, to activate contact.
3. If contact is hooked to the Capacitor trip & Shunt trip combo on main breaker, insure main breaker trips.
4. If contact reports to energy management system, insure energy management system receives loss of phase/voltage signal.

G. Ground Fault Testing

1. Inspect switchboard main bonding jumper for proper size and termination on source side of neutral disconnect link.
2. Inspect Grounding electrode conductor to assure proper size and secure termination to ground bus.
3. Inspect switchboard neutral bus downstream of the neutral disconnect link to verify the absence of ground connections.
4. Set Ground fault setting per calculations in E above.
5. Verify Ground Fault System Performance for correct response of the circuit-interrupting device by secondary (or primary if local inspector requires) ground sensor current injection. Record ground fault pickup current. Verify breaker trips and indicator works.
6. Verify Ground fault does not pick-up at 90% of pickup setting.
7. Record settings, results, and any other notations on the Low Voltage Breaker data form.

3.03 CABLE TESTING

A. Insulation System – To ensure integrity of the cable insulation system after shipping, site storage, and pulling through conduit an insulation resistance test will reveal insulation deformities and moisture in the cable that otherwise might cause an untimely premature cable failure possibly damaging equipment or personnel. Perform the following on all customer power cables to and from main switchboard. This would include cables from utility transformer to MSB and cables from MSB to all secondary switchboards or distribution panels.

B. Visually inspect visible portion of cables for observable defects.

C. Insure all solid-state devices are disconnected from the system prior to meggering. Typically but not all-inclusive would be Meters, trip units with voltage sensing, and TVSS units.

D. Isolate cables by opening breakers. Meggering thru equipment like motors or transformers will produce erroneous readings.

E. Perform insulation-resistance tests on each line and load cable, phase-to-phase, phase-to-ground, phase-to-neutral and neutral-to-ground in each conduit. Megger at 1000 VDC for 600 volt cable and 500 VDC for 300 volt cable for one minute.

F. Insulation resistance shall be above 100 ohms and preferably above one megohm.

G. Ensure cable termination connections are tight after testing.

3.04 CAPACITOR BANK TESTING

A. Inspection.

1. Visually inspect for obvious shipping damage.
2. Verify all connections are tight.

B. Setup controller to step in all banks with thresholds.

C. Verify no harmonic interaction is occurring using a power quality meter recording harmonics to the 50th over a 24-hour period to insure IEEE 519 compliance.

D. Train district personnel on the operation of the controller.

1. Training is to include review of original analysis, verification, review controller operation, safe practices with capacitors, fusing indicators (internal & external)

3.05 Restoration of Equipment and Reports

A. Before energizing:

1. Remove and account for all test equipment, jumper wires, and tools used during testing.
2. Remove and account for safety grounds and tools.
3. Replace all barriers and covers, close all doors, and secure all latches.
4. Remove safety locks and tags.
5. Insure all adjustable meters, relays and trip devices are properly set in accordance with the coordination study.
6. Apply testing label to equipment

B. Note corrective actions taken, deficiencies, recommendations and any general comments.

C. Finish recording data on test forms, completely filling in the blanks. Enter into electronic database as required in section 1.04.E

D. Turn in 3 copies of report to engineer for approval.

3.06 Follow up testing

A. Included in above cost as part of original project.

B. One month prior to the expiration of the factory warranty schedule & perform a thermal scan of all breaker to cable, breaker, bus connections, cable to panel chassis. Scope is to include main transformer connections, main switchboard, all secondary switchboards, transformers, and panels. Tests are to be done with building normal loaded for 2 hours, not in with partial or unloaded condition.

C. Thermal scans temperatures shall be evaluated as follows (based on comparable size or adjacent phases and loaded breakers, bus connections, and terminations)

1. 1-3 degrees C rise, Investigate as to the cause of temp rise.
2. 4 – 15 degree C rise, Repair as soon as possible.
3. 16 or higher degree C rise, Repair immediately.

D. Ensure that all bus and breaker to cable connections are tight.

E. Note corrective actions taken, deficiencies, recommendations and any general comments.

F. Finish recording data on test forms, completely filling in the blanks.

G. Turn in 3 copies of report to engineer for approval.

END OF SECTION 260573

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 260923 - OCCUPANCY SENSOR LIGHTING CONTROLS (PERFORMANCE SPECIFICATION)

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. Design Requirements:

1. The system shall utilize occupancy sensors and related devices to automatically control the lighting
2. Ceiling sensors shall be low voltage sensors.
3. Wall sensors shall be suitable for control of 120-volt or 277-volt lighting.
4. All switching devices shall utilize zero-crossing circuitry
5. Coverage areas for major motion and minor motion shall be determined in accordance with Section 3 of NEMA WD 7 Guide.

B. Performance Requirements:

1. The system shall be designed to automatically turn room lighting “off” when no room occupant is sensed for a pre-determined time period. The system shall be designed to turn room lighting on by either manual “ON” mode or automatic “on” mode, as required by Code.
   a. In **MANUAL “ON” MODE**, lights will only turn on via wall switch and shall remain on until the sensor detects no room occupants for the pre-determined time period. This the sensor shall operate in vacancy mode.
   b. In **AUTOMATIC “ON” MODE,** lights will turn on immediately upon sensing a room occupant and shall remain on until the sensor detects no room occupants for the pre-determined time period. This sensor shall operate in occupancy sensor mode.
2. Vacancy and Occupancy sensing devices are to incorporate dual technologies as further indicated below.
3. For room sensors, the initial trigger motion detection may be based on either major motion or minor motion. The maintained motion detection shall be based on minor motion.
4. For corridor sensors, the initial trigger motion detection and the maintained motion detection shall be based on major motion.
5. System to be designed to deliver a fully operational system.
6. In areas with multi-level switching sensor shall provide two dedicated relays and low voltage momentary switches. Each relay shall have independent programmable time delays.
7. In areas with daylight zone(s) provide dedicated relay(s) and low voltage momentary switch(es) for each daylight zone. Each relay shall have independent programmable time delays.
8. System to be design to account for any sensor obstructions including but not limited to walls, pendant lights, projectors, bulkheads, etc. **Sensors indicated on plans are to identify rooms to incorporate occupancy sensors, not to indicate quantity or sensor location.**
9. All models shall have a field programmable function for problematic areas with unforeseen reflective surfaces to eliminate “false turn-ons”.

C. Section Includes:

1. Lighting controls for rooms indicated on plans include occupancy sensors and as required by the IECC.

2. Section excludes night light functions, daylight harvesting, and theatrical lighting.

D. Related Sections:

1. Drawings and general provisions of the contract, including General and Supplementary Conditions, Division 1 specifications, and section 260500.
2. Cable Management – Section 271123

E. Reference: NEMA Guide Publication WD 7-2000 Occupancy Motion Sensors

1.02 SUBMITTALS

A. Submit product data for all products incorporated.

B. Shop Drawings:

1. Coordinate with device manufacturer for type, mounting location, and height for each space shown with respect to architects ceiling heights.
2. Submit shop drawings indicating the occupancy sensor type and location indicating sensor range limits.
3. Indicate manufacturers aiming lay-out of all devices.
4. Including part #'s and wiring diagrams.

C. Project Record Documents:

1. The contractor shall accumulate during the job's progress the following data, in multiple duplication (three each), prepare in 3-ring binders of sufficient size, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the owner:
   a. All warranties, guarantees and manufacturer's direction on equipment and material covered by the contract
   b. Approved fixture / equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instruction shall also include recommended maintenance and adjustment instructions and other information necessary for proper operation of the occupancy sensor lighting controls.
   e. Any and all data and or plans required during construction.
   f. Repair parts list of all major items and equipment including name, address and telephone number of the local supplier or agent.
   g. The first page or pages shall have the name, addresses and telephone numbers of the following: General Contractor and all sub-Contractors and major equipment suppliers.
   h. As Built drawings shall indicate all sensor, relay, and power / slave pack locations and wiring configurations as installed.
   i. Provide documentation of manufacturer's final testing, adjusting, and start-up of the completed installation.

D. Prior to installing any wiring or low voltage cable, submit an organized bundle of cable including one of each cable type and color that will be utilized in this work. Each cable should be about one foot long and have the manufacturer's printed markings. Neatly identify each cable and color to be used indicating what they serve. Include the project name, discipline of work, sub-contractor's name, and date.

1.03 QUALITY ASSURANCE

A. WARRANTY

1. Provide a five year parts and one year labor warranty on both wall and ceiling occupancy sensor lighting controls, coverage to begin at the time of Project Substantial Completion.

B. OWNER'S INSTRUCTIONS:

1. The contractors shall require the manufacturer to provide instruction to the owner's personnel in the operation, adjustment, and maintenance of the system. The manufacturer shall provide documentation of such training in the closeout submittals.

C. START-UP

1. Prior to substantial completion of the project, the contractor shall require the manufacturer to test the operation of the system to ensure the proper operation of the system throughout the range of building operating conditions. The manufacturer shall provide documentation of such start-up in the closeout submittals.

1.04 ATTIC STOCK

A. In addition to the product necessary to complete the installation provide the following items in factory un-open packages for each campus:

1. Motion Detectors/sensors - Three (3) of each type used. Provide power pack for each.

PART 2. - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. Lutron
2. Leviton
3. Sensor Switch
4. Cooper Controls
5. Wattstopper
6. Hubbell

B. Other Manufacturers must be approved in writing prior to bidding

2.02 MANUFACTURED UNITS

A. General Requirements as applies to all types of sensors:

1. Ceiling mounted sensors shall be designed to turn room lighting "on" Immediately upon sensing a room occupant unless specified or noted otherwise, and to turn room lighting "off if no room occupant is sensed for the entire period of the sensors off time delay, regardless of the shape of the room.
2. Wall mounted sensors shall have the same functions as ceiling mounted sensors, except that lighting turn-on may be automatic or manual.'
3. Sensors shall have built-in timing and load control-driving circuitry.

4. All sensors shall have user-adjustable controls for adjusting sensitivity of a sensor to its controlled area, and for adjusting "time to light off' delay. Time delay shall be made settable down to 5 minutes. Sensors must also include a time delay adjustment of one minute or less for sensor operation testing. Adjustment controls shall be recessed In order to limit tampering.
5. An Internal bypass "manual-on" switch shall be provided for each sensor for use in the event of sensor or failure. When the bypass switch is activated, lighting shall remain constantly "on" and on/off control shall divert to wall switches until sensor is replaced. Override shall be accomplished without the use of unit specific or special tools. The bypass control shall also be recessed to limit tampering.
6. Sensors shall be able to be wired in parallel to allow coverage of large areas.
7. All sensors shall be manufactured by the same company and shall be aesthetically compatible: i.e. from the same product line or generation of products.
8. Sensor to work compatible with energy saving electronic ballasts, where applicable.
9. All sensors shall work in conjunction with wall switches as shown on the plans and control one or more switched circuits as required.
10. All sensors shall be low voltage.
11. All lighting control system products shall be UL listed and labeled, individually and as a system, for the specific applications utilized on this project.
12. Provide wire guards for wall mounted sensors at athletic areas (i.e. gymnasiums, field houses, etc) and other areas where subject to physical damage.

B. Infrared Occupancy / Vacancy Sensors:

1. In addition to the general criteria above, the following criteria apply to passive infrared occupancy sensors, regardless of location or mounting type.
2. The passive infrared detector shall utilize a temperature compensated dual element sensor and a multi-element fresnel lens.
3. Infrared sensors shall have a daylight filter that ensures the sensor IS Insensitive to short wavelength infrared waves such as those emitted by the sun.

C. Ultrasonic Occupancy / Vacancy Sensors:

1. In addition to the general criteria above, the following criteria apply to ultrasonic occupancy sensors, regardless of location or mounting type.
2. Ultrasonic sensors shall provide volumetric coverage without gaps in coverage within the controlled area.
3. Sensor operating frequency shall not interfere with other sensors in other areas.

D. Sensor Types and Applications:

1. Sensors shall provide dual technology as required to provide optimal performance accounting for room conditions including obstruction at each individual room or space.

E. Control/Switching Units:

1. Control unit shall be an integrated self-contained unit consisting internally of a load switching control relay and a transformer to provide low-voltage power sensors. Control unit shall meet UL 2043. Control unit relays and features shall be as follows.

F. Relay contacts shall have ratings of

1. at least 20A – 120 volts ac incandescent.
2. at least 20A – 120 volts ac ballast.
3. at least 20A – 277 volts ac ballast.

4. at least 1 HP at 120-250 VAC, 60 Hz
5. Relay contacts shall be isolated

G. Wiring:

1. Wiring between sensors and control units shall be three conductors, 18 AWG, stranded UL classified. Teflon-jacketed. Wiring shall be plenum rated in plenum spaces where required.
2. Wireless sensors and or components are specifically prohibited.

PART 3. - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions:

1. If the work is to be performed in an existing facility, visit the site of the proposed work and observe its conditions so that you may be fully informed as to the materials, labor, workmanship and conditions under which the work is to be done.
2. No allowances shall be made on account of any errors, negligence or failure to be aware of the condition of the existing site.

3.02 INSTALLATION

A. General

1. Install occupancy sensor lighting controls as required by code and where indicated, in accordance with manufacturer's written instructions and project shop drawings, applicable requirements of NEC, and recognized industry practices to ensure that products serve intended function.

B. Sensor Type Selection / Design

1. It shall be the equipment manufacturers'/contractors' responsibility to select the appropriate type of sensor for each room, subject to the following design guidelines:
   a. It shall be the equipment manufacturers / **contractors' responsibility to provide the quantity of sensors required for complete and proper coverage without gaps within the range of coverage of controlled areas.** Rooms shall have 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room. The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only rooms that are to be provided with sensors. The equipment manufacturer/contractor shall provide additional sensors if required to properly and completely cover the respective room. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
   b. Exact locations of control unit hardware boxes shall be based on observing good installation practice and shall be coordinated with other elements of the reflected ceiling plan. Control unit hardware shall be fully concealed.

C. Box Condition

1. Install low voltage lighting control devices only in electrical boxes that are clean, free from excess building material, debris, and similar matter.

D. Wiring

1. All branch circuit wiring shall be installed in an approved raceway.
2. Low voltage wiring shall be installed in an approved raceway where concealed in inaccessible locations or exposed. Where low voltage wiring is concealed in accessible ceiling plenums, it may, at the Contractors option, be routed without a raceway using air plenum rated multi-conductor cable. All control wiring shall be minimum 18 gauge stranded copper.
3. All low voltage wiring shall be color coded and identified or tagged at terminals to assist with future maintenance.

E. Sensor Testing and Adjustment

1. At the time each sensor is installed, it shall be adjusted as follows:
   a. Sensitivity shall be adjusted for proper occupant detection appropriate to the usage of the room.
   b. Set time delay at approximately 20 to 30 minutes after setting in a 30 second test to verify sensor/control unit operation.
   c. Check indicator light of each sensor to verify that occupancy is being detected in the range desired.
   d. Sensor operating frequencies shall be selected to prevent interference with other units in the vicinity as required.
   e. Ensure that there are no obstructions which could block proper sensor coverage, thereby minimizing the sensor detection zone.
   f. Contractor to provide additional adjustments upon intended user acclimation of devices as needed.
   g. Occupancy sensors may be affected by various conditions in the room. It may be necessary for the Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room. The Contractor/equipment manufacturer shall have final responsibility for proper operation and coverage of the system in each room and should therefore make labor allowance for such changes and adjustments. The Contractors is also responsible for acquiring approval from Engineer for any changes or deviations from project specifications.

F. Bypass Switches

1. Install line voltage bypass switches in room line voltage wiring for all rooms with ceiling and wall mounted sensors and control/switching units. Switches shall be series wired with control/switching units to provide positive off control and function as standard on/off switches if the occupancy sensor fails and is bypassed.

3.03 TRAINING

A. Upon completion of testing and adjustment, the Contractor shall demonstrate operation of the system to representatives of the Owner.

B. The Contractor shall instruct the Owner’s personnel in proper maintenance, adjustment, and operation of the occupancy sensor lighting controls.

END OF SECTION 260923

SECTION 262213 - DRY TYPE TRANSFORMERS

PART 1. - GENERAL

1.01 DESCRIPTION OF THE WORK

A. The extent of the dry type transformer work is indicated on the drawings and schedules, and by the requirements of this section.

1.02 SUBMITTALS

A. Submit manufacturer's data on dry type transformers, vibration isolators and accessories.

B. Submit dimensioned drawings of installed dry type transformers including, but not limited to, housekeeping pads, vibration isolators, related panelboards and other equipment, conduit connections and equipment near the dry type transformers.

PART 2. - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Except as otherwise indicated, provide dry type transformer manufacturer's standard materials and components as indicated by their published product information; designed and constructed as required for a complete installation.

B. Provide energy efficient transformers, of the two winding type, self cooled, with ratings (KVA) as indicated on the drawings.

C. Transformers shall be designed, manufactured, and tested in accordance with applicable ANSI/NEMA Standards, and shall be listed by Underwriters Laboratories.

D. Transformers 15 kva and above shall be 150^{o} C temperature rise above 40 ^{o}C ambient. Insulating materials shall be in accordance with NEMA ST20 standard for a 220 ^{o}C UL component recognized insulation system.

E. All insulation materials shall be flame retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

F. The transformer core shall be constructed with high grade, non-aging, grain oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The core volume shall allow efficient transformer operation at 10% above the highest tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum or copper with continuous wound construction.

G. The core and coil assembly shall be impregnated with a non-hydroscopic thermo setting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration absorbing pads and securely bolted to the base to minimize sound transmission.

H. Enclosures shall be made of heavy gauge cold rolled steel and shall be degreased, cleaned, phosphatized, primed and finished with ANSI 61 color weather resistant enamel. The enclosure construction shall be ventilated, NEMA 2 drip proof, with lifting holes. All ventilation openings shall be protected against falling dirt. Transformers shall be equipped with a wiring

compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 ° C.

I. The core of the transformer shall be visibly grounded to the enclosure.

J. The following tests shall be made on each transformer:

1. Ratio tests on the rated voltage connection and on all tap connections.
2. Polarity and phase relation tests on the rated voltage connection.
3. Applied potential tests.
4. Induced potential tests.

K. Furnish taps as follows:

1. Two 2-2% above normal rating.
2. Four 2-2% below normal rating.

L. Transformers shall be manufacturer's standard "Quiet" model, GE Type QHT or equal. Maximum noise ratings shall not exceed:

151-300 KVA	55 decibels.
51-150 KVA	50 decibels.
10-50 KVA	45 decibels.

Decibel ratings shall be taken in accordance with 1974 ANSI/NEMA Standards.

M. Primary rating shall be:

1. 480 volt, 3-phase, 3-wire, delta
2. 480 volt, single phase, 2-wire.

N. Secondary rating shall be

1. 120/208 volt, 3-phase, 4-wire, wye
2. 120/240 volt, single phase, 3-wire.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install dry type transformers as indicated, in accordance with the applicable requirements of the NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Do not permit transformers to be used as worktables, scaffolds or ladders.

C. When final connection has been made, check secondary voltage at dry type transformers and make tap adjustments required to obtain correct voltage.

D. Isolation procedures described hereinafter shall be over and above those provided by the transformer manufacturer.

1. For floor or roof transformer installations, use spring type isolator Korfund Series P or equal, sized for 2" defection, with sound pad, one at each corner of the transformer.

2. For floor or roof transformer installation, use pad type Korfund Elasto-Grip, waffle, or equal sized to load 50 pounds per square inch, one at each corner of the transformer.
3. For structure hung transformer installations use Consolidated Kinetics Model SHU spring type isolators or equal, sized such that rated spring deflection is not exceeded. Refer to Section "Standard Details and Schedules" for typical installation detail.
4. For wall hung transformer installations use spring type Korfund Series P or equal, sized for 2" deflection, with sound pads at each corner of the transformer. Hanger shall be as manufactured by transformer manufacturer and installed as noted on the plans.
5. For wall hung transformer installations use pad type Korfund Elasto-Grip, waffle, or equal, sized to load 50 pounds per square inch, located between the hanger and the wall.

E. Bonding connection shall be solderless lug on the inside of the transformer enclosure in accordance with NEC.

F. Transformers installed on a roof shall be installed on 6" x 6" redwood (or penta-treated pine) runners installed in pitch pans. Fill pitch pans full of hot pitch. Installation shall be compatible with roof materials and installation.

G. Install weather shields on transformers installed outdoors.

3.02 TESTING

A. Apply standard potential, loss ratio, polarity and continuity tests to each transformer.

B. Provide the test data results for each transformer.

C. Provide certification of the test data accumulated on similar units to show the expected values of sound levels, temperature rise, full load losses, regulation and impedance.

END OF SECTION 262213

SECTION 262400 - SWITCHBOARDS, PANELBOARDS AND ENCLOSURES

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The types of panelboards and enclosures required for the project include the following:

1. Power distribution switchboards.
2. Power distribution panelboards.
3. Lighting and appliance panelboards.
4. **Third Party Inspection prior to energizing.**

1.02 QUALITY ASSURANCE

A. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

B. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract
   b. Approved fixture/equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   e. Any and all data and/or plans required during construction.
   f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
   g. The first page or pages shall have the name, addresses and telephone numbers of the following; General Contractor and all sub-contractors, Major Equipment Suppliers.

C. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

D. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

E. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

PART 2. - PRODUCTS

2.01 SWITCHBOARDS AND PANELBOARDS, GENERAL

A. The Contractor shall furnish and install approved panelboards of the types indicated and specified herein at locations as shown on the drawings.

B. Panelboards shall comply with the following industry standards:

1. UL Standards: Panelboards - UL 67.
2. Cabinets and Boxes - UL 50.
3. Circuit Breakers and Switchboards - UL 891.
4. National Electrical Code.
5. NEMA Standard - PB1.
6. NEMA Standard - PB2.

C. Switchboards and Panelboards shall be rated SE where required for Service Entrance duty. Ground fault sensing and tripping shall be furnished and installed for SE switches, 480 volt, 800 ampere or larger, and as otherwise scheduled.

D. Interiors shall be completely factory assembled.

E. Panelboard schedules shall govern where this specification is in conflict with panelboard schedules.

F. Where interrupting capacity in excess of that specified above is scheduled, appropriate panels and breakers shall be furnished.

G. Unless otherwise noted, full size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing circuit requiring a neutral connection. A ground bus shall be included in all panels.

H. Boxes shall be at least 20" wide made from galvanized steel. Provide gutter space in accordance with National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space.

I. Metal barriers shall be installed between vertical sections of switchboard sections. Openings shall be effectively sealed where bus bars pass from one section to another. In general, feeder and branch circuit conduits shall exit from the section to which connected.

J. Where two or more switchboard sections are placed next to each other, the front to rear dimensions shall be the same, unless shown or scheduled otherwise.

K. Doors shall have flush type cylinder lock and catch except doors over 48" in height shall have auxiliary fasteners top and bottom of door in addition to the flush type cylinder lock and catch. Panelboard trim clamps shall be of the indicating type.

L. Door hinges shall be concealed. Locks shall be keyed alike; a directory frame and card having a transparent cover shall be furnished with each door.

M. Exterior and interior steel surfaces of the trim shall be properly cleaned, primed with rust inhibiting phosphatized coating and finished with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for at least 3/4” all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim clamps shall not be accessible when the panel door is closed and locked.

N. Main bus bars shall be copper sized in accordance with UL standards.

2.02 FUSIBLE SWITCH PANELBOARDS

A. Fusible switch distribution panels shall be Cutler Hammer Pow-R-Line or Square ‘D’ or equal of the voltage and rating scheduled.

B. Protective devices shall be quick-make, quick-break fusible switches Cutler Hammer Pow-R-Line or Square ‘D’ or equal. Fusible switches rated 30 to 600 amperes shall have fuse clips suitable for Class RK1 fuses and shall be UL Listed at 100,000 A.I.C. Fusible switches 800 amperes through 1200 amperes shall be furnished with Class L fuse clips and UL labels for 200,000 A.I.C. Class RK1 or L fuses shall be installed in each switch as scheduled.

C. Fusible switch distribution panels shall be Square D of equal of the voltage and rating scheduled.

D. Protective devices shall be quick-make, quick-break fusible switches Square D. Fusible switches rated 30 to 600 amperes shall have fuse clips suitable for Class RK1 fuses and shall be UL Listed at 100,000 A.I.C. Fusible switches 800 amperes through 1200 amperes shall be furnished with Class L fuse clips and UL labels for 200,000 A.I.C. Class RK1 or L fuses shall be installed in each switch as scheduled.

2.03 CIRCUIT BREAKER DISTRIBUTION PANELS

A. Circuit breaker distribution panels shall be Cutler Hammer Pow-R-Line or Square ‘D’ or equal of the voltage, rating and interrupting capacity scheduled.

B. These panels shall be provided with molded case circuit breakers, Cutler Hammer or Square ‘D’ or equal or better as required and scheduled.

C. Breakers 100 ampere through 400 ampere frame sizes shall be thermal-magnetic trip with inverse time current characteristics, unless otherwise noted. Breakers 600 ampere frame and above shall have adjustable instantaneous trip.

D. Molded case breakers shall have a minimum RMS interrupting capacity as scheduled.

E. Current Limiting Devices: Protective devices with current limiting properties shall be provided as noted on the drawings.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Lighting and Appliance Panels shall be furnished and installed as scheduled.

B. Panels shall be Square 'D', Cutler-Hammer Pow-R-Line or equal with bolt-on branch circuit breakers.

2.05 MAIN DISTRIBUTION PANEL

A. Provide Microprocessor based metering module to the main distribution panel. Eaton Power Xpert Meter 2000 Series or equal by switchgear manufacturer.

B. Provide ‘Taylor’ phase guard relay part # **PNDRLV-480.** Provide with one set of wire out contacts for connection to EMCS system, and one set of contacts connected to shunt-trip for main breaker provided with capacitor trip.

PART 3. - EXECUTION

3.01 INSTALLATION OF PANELBOARDS AND ENCLOSURES

A. Install panelboards and enclosures, including electrical connections, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the NECA "Standard

of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Coordinate installation of panelboards and enclosures with cable and raceways installation work.

C. Connect A, B and C phases respectively to bus number 1, 2 and 3 from left to right or top to bottom.

D. Balance panels by checking each phase of all panels under full load and arrange so that all phases carry the same load as near as possible.

E. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secured.

F. Furnish and install an engraved laminated nameplate for each circuit breaker or fused switch in distribution panelboards. Refer to electrical equipment identification section of the specifications.

G. Furnish and install 20 gauge galvanized sheet metal chase covers above and below surface mounted panels in accessible areas except mechanical rooms.

H. Place free standing or floor mounted equipment on housekeeping pads. Refer to general section of the specifications.

3.02 TESTING

A. The coordination and ground fault protection system shall be performance tested when first installed on the site. The test shall be conducted in accordance with instructions which shall be provided with the equipment. A written record of this test shall be made and shall be available for inspection by the local code authority.

B. **Contractor shall include Third Party inspection and certification for all switchboards, panelboards and enclosures prior to energizing of equipment. Inspection to include all connections and lugs.**

END OF SECTION 262400

SECTION 262405 - INTEGRATED FACILITIES SWITCHBOARDS

PART 1. - GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install, where indicated, a free-standing, deadfront type low-voltage distribution switchboard, utilizing group mounted circuit protective devices, integrated Panelboards, and other equipment as specified herein, and as shown on the contract drawings.

1.02 REFERENCES

A. The low-voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:

1. NEMA PB-2
2. UL Standard 891. The low-voltage switchboard shall be UL 891 labeled.

1.03 SUBMITTALS

A. The following information shall be submitted to the Engineer **USING PANEL DESIGNATIONS INDICATED PER PLANS**:

1. Front view elevation
2. **Floor plan with ACTUAL room conditions and dimensions shown.**
3. Top view
4. Single line diagram
5. Nameplate schedule
6. Component list
7. Conduit entry/exit locations
8. Assembly ratings including:
   a. Short-circuit current rating
   b. Voltage
   c. Continuous current rating
9. Major component ratings including:
   a. Voltage
   b. Continuous current
   c. Interrupting ratings
10. Cable terminal sizes
11. Published product technical data sheets and catalog pages.

B. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in paragraph 1.03
2. Certified production test reports
3. Installation information
4. Seismic certification and equipment anchorage details.

C. The final (as-built) drawings shall include the same drawings as the original construction drawings and shall incorporate all changes made during the manufacturing process.

1.04 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the circuit protective devices, transformers, SPDS within the assembly. The manufacturer shall build the switchboard in the DFW area in there own factory to allow for inspection, for future parts, service needs, and quality control. The gear shall be purchased in the local DFW area to maintain service to the contractor and end user.

B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of local school installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The manufacturer shall maintain switchboard manufacturing plants within the United States of America to provide parts and service. These facilities shall have the ability to replace and/or modify equipment as deemed necessary. The plant shall demonstrate the stocking of an inventory of breakers of all sizes for emergency use. A list of these plants, phone numbers and contacts shall be provided at the request of the owner. Cutler-Hammer has demonstrated having these regional switchboard manufacturing plants. All other listed acceptable manufacturers must supply spare parts as part of their bid. If the manufacturer does not have these facilities, they must include spare parts as part of their Bid. The Spare Parts should include one of each type of Circuit Breaker above 100 amps and 3 for each trip rating 100 amps and below used in the Switchboard.

E. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, UBC: a peak of 0.75g, and a ZPA of 0.38g. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

F. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.
2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.05 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.06 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2. - PRODUCTS

2.01 MANUFACTURERS

A. Eaton/ Cutler-Hammer – Integrated Facility Systems (IFS)

B. Square D – Integrated Power Center (IPC2)

C. Siemens – PowerWall Switchboards

D. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to proposal or bid date.

E. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage Main Switchboard Section shall be fully rated for 65,000 amperes symmetrical at rated voltage. Sub-panels shall be fully rated to meet requirements shown on drawings. Series rating is not permitted.

B. Voltage rating to be as indicated on the drawings.

2.03 CONSTRUCTION

A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers, hinged front panels, side or rear covers shall be formed with bent over edges to provide sturdy covers and doors. All steel parts shall be painted, not galvanized, to reduce sharp edges, with the exception of the breaker mounting rails. Provide adequate ventilation within the enclosure.

B. Door swings of panels must not hinder egress from within the room**. Door must be able to swing shut in the direction of egress.** Panel doors can only encompass one vertical section, large doors incorporating two adjacent vertical sections are **NOT ALLOWED**.

C. The manufacturer shall integrate and assemble automatic transfer switches, Panelboards, SPDS, transformers, lighting contactors & control into the switchboard. Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors. All breakers require a bolted connection to the bus, plug in breakers or assemblies will not be acceptable.

D. Distribution Panelboards --800 amps & greater

1. Distribution Panelboards with bolt-on devices contained therein shall have fully rated interrupting ratings as indicated on the drawings. Trims shall cover all live parts. Switching device handles shall be accessible. Engraved nameplates are to identify all distribution breakers Panelboards shall be Cutler-Hammer type Pow-R Line-4a. Panelboards shall have molded case circuit breakers as indicated below.
2. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics and shall be Cutler-Hammer type Series C or approved equal. Ground fault protection shall be provided where indicated.
3. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
4. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

E. Branch Circuit Panelboards—600 amperes & less

1. Branch Circuit Panelboards with bolt-on devices contained therein shall have fully rated interrupting ratings as indicated on the drawings. Panelboards shall be Cutler-Hammer type Pow-R Line-1a, 2a, & 3a. Panelboards shall have molded case circuit breakers as indicated below.
2. Bolt-in type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
3. Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits. Three quarter inch ¾” breakers will not be acceptable in any part of the Panelboard.
4. Circuit breakers shall have a minimum interrupting rating of 10,000-amperes symmetrical at 240-volts, and 14,000-amperes symmetrical at 480-volts.
5. Each Branch Circuit Panelboard shall contain door in door trim with 2 lockable doors. Outer door is to be keyed to prevent access to wiring by unauthorized personnel. Dead front is to cover breakers. Keying shall be independent of interior panel door to allow limited access to breaker handles. Inner doors shall have a semi-flush cylinder lock and catch assembly. Locks are not permitted to be over 5’ high.
6. The panels shall be recessed in the switchboard enclosure a minimum of four inches from the front of the switchboard to allow easy access to line and/or load conductors entering/exiting top of bottom. Trim doors shall be laser cut to assure proper fit.
7. Doors in panelboard trims shall not uncover any live parts. Due to the recessing of panels, a 4 inch minimum deep guard is required between breaker handles and load side of breaker, exposed when the inner door is opened. This guard is to mounted to the outer door.
8. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each inner door.
9. Sections with 2 panels shall be mounted in sections 6” wider than standard panelboard 20” wide to accommodate increased wires in gutter.
10. 42 circuit panels shall be able to be mounted above a “K1” 150 KVA transformer or a “K13” 112.5 KVA transformer.

F. Feeder breakers within the switchboard shall be factory wired to the associated Panelboards. Wire markers shall be utilized to identify the conductors and matched on both ends with panel designation and phase markings. Where shipping splits are shown, provide adequate wire and associated barriers, conduit and other necessary materials for contractor connection. The switchboard manufacturer shall connect and secure either the line or load side of each connection on shipping splits.

G. All sections of the switchboard shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible.

H. The assembly shall be provided with adequate lifting means.

I. The Switchboard shall be equal to Cutler-Hammer type Pow-R-Line C IFS utilizing the components herein specified and as shown on the drawings.

J. The Main Switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

K. The Main Switchboad shall be supplied with a 250KA Surge Protective Device, (SPD) where indicated, shall be based on Cutler-Hammer SPD 250 type with 250 KA per phase

1. Let thru ratings shall meet or be less than (better performance) 655V for IEEE C3 waveform, 440V for IEEE C1 waveform, 380V for IEEE B3 waveform, & 500V per UL1449. Units shall have been tested to withstand >1500 IEEE C3 waveforms by 3rd party testing.
2. SPDS shall have 50dB of filtering at 100 KHz.
3. Unit shall not have plug in modules that degrade performance.
4. MOV's shall be mounted on a plane of Copper, individually fused, & monitored with lights, surge counter, form C contact and alarm horn to indicate failure.
5. SPDS shall be UL listed per 1449 3rd Edition & 1283 with 10-year warranty.

2.04 RATINGS

A. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are not permitted.

2.05 BUS

A. All bus bars shall be silver-plated copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum (outside the enclosure).

B. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane.

C. Panelboard bus bars shall be vertically mounted in panel chassis. The panel chassis parts shall be the same parts used in the manufactures standard panels, in the unlikely event of a failure parts are stock parts and readily available.

D. A bolted ground bus shall be included in all panels.

E. Full-size (100%-rated) insulated neutral bars shall be included for Panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

F. In the case of two "twin" panels (84 Circuit or more) one above the other, the panels are to be hard bussed, for greater fault tolerance, rather than cable connected, bussing shall be sleeve insulated. Cable connecting of twin panels will not be permitted.

G. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.

H. A copper ground bus (minimum 1/4 x 2 inch), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. The ground bus shall be carried forward on the left side of all transformer sections.

I. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type bellville washers.

2.06 LIGHTING CONTROLS.

A. The switchboard manufacturer shall integrate approved environmental control systems and components into the switchboard assembly.

B. The switchboard manufacturer shall integrate lighting control systems and components into the switchboard assembly. The lighting control system shall be as specified in other sections of Specifications.

2.07 SPDS For PANELBOARDS

A. SPDS, where indicated, shall be based on Cutler-Hammer CVL 100 type with 100 KA per phase for all second stage downstream of SE SPDS (In MDP).

B. Let thru ratings shall meet or be less than (better performance) 655V for IEEE C3 waveform, 440V for IEEE C1 waveform, 380V for IEEE B3 waveform, & 500V per UL1449. Units shall have been tested to withstand >1500 IEEE C3 waveforms by 3rd party testing.

C. SPDS shall have 40dB of filtering at 100 KHz.

D. Unit shall not have plug in modules that degrade performance.

E. MOV's shall be mounted on a plane of Copper, individually fused, & monitored with lights, form C contact and alarm horn to indicate failure.

F. SPDS shall be UL listed per 1449 & 1283 with 10-year warranty.

G. Hardwire installations shall use 14" or less wire and be installed with about 2 twists per inch in wiring, phase & neutral/ground connections, to improve performance.

2.08 DRY TYPE DISTRIBUTION TRANSFORMERS

A. RATINGS

1. kVA and voltage ratings shall be as shown on the drawings. Supply K13 or HMT as required per drawings.
2. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.
3. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:
   a. 15 to 50 kVA 45 db
   b. 51 to 112.5 kVA 50 db

B. CONSTRUCTION

1. Insulation Systems

a. Transformers shall be insulated as follows; 220 degrees C insulation system based upon 150 degree C rise
b. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient.
c. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

2. Core and Coil Assemblies
   a. Transformer core shall be constructed with high-grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction.
   b. The core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration-absorbing pads. Taps shall be two (2) steps above and four (4) steps below nominal voltage in 2.5% increments.

C. SWITCHBOARD INSTALLATION

1. When dry type distribution transformers are shown on drawings, the switchboard manufacturer shall integrate the transformer into the switchboard.
2. The transformer shall be secured in a manner that assures the structural integrity of the vertical switchboard section and the transformer.
3. The switchboard–manufacturer shall wire the transformer from the feeder overcurrent device to the line side of the transformer in accordance with UL and the National Electrical Code utilizing copper conductors.
4. The switchboard manufacturer shall wire the secondary side of the transformer to the load or Panelboard shown on the drawings in accordance with UL and the National Electrical Code utilizing copper conductors.
5. Within the switchboard provide adequate ventilation for the transformer and other installed components.
6. Transformers used shall be the manufactures standard transformer Core & Coil so that in the unlikely event of a failure, a standard unit can be used for replacement. A standard transformer label shall be applied to the front section cover to aid in getting replacement part.
7. Provisions for heat dissipation shall be made to insure breakers don’t prematurely trip above transformers.

2.09 WIRING/TERMINATIONS

A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.

C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

E. The switchboard manufacturer shall wire and label as factor installed all Panelboards, transformers and/or automatic transfer switch from the associated feeder breaker (in the Main section of the switchboard) to the Panelboard as noted on drawings. Phase labels shall be color coded per NEC, and state “Factory Installed Phase A” for phase A and similarly for phase B, C, & neutral. Green colored ground wire shall connect each panel ground bar to the ground bus. Color-coding with tape is not permitted. This wiring is not allowed to be done in the field per NEC Article 384.

2.10 MISCELLANEOUS DEVICES

A. Key interlocks shall be provided as indicated on the drawings.

2.11 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer’s name, general order number, and item number.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

2.12 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

PART 3. - EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory.
2. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment.
3. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

C. Factory tests as outlined above shall be witnessed by the owner's representative.

1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed.
2. The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility.

3.02 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.03 FIELD TESTING

A. The ground fault protection system shall be tested when first installed on site to insure performance. A written record of this test shall be made available for inspection by the local code authority.

3.04 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.

B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills provided the floor is level to 1/8 inch per 3-foot distance in any direction. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.05 FIELD ADJUSTMENTS

A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study and protective device coordination study.

B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

END OF SECTION 262405

SECTION 262425 - SAFETY SWITCHES AND FUSES

PART 1. - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of safety switches, disconnect switches or fuse work is indicated on the drawings and schedules, and by the requirements of this section.

B. The types of safety or disconnect switches required for the project include the following:

1. Equipment disconnects.

C. Fuses used in electrical apparatus, but not furnished by the manufacturer of the apparatus, shall be furnished under this section.

1.02 QUALITY ASSURANCE

A. Safety switches shall comply with applicable provisions of UL # 98 and NEMA KS-1.

PART 2. - PRODUCTS

2.01 FABRICATED SWITCHES

A. In accordance with the service indicated, use 600 volt switches, single throw, fusible, or non-fusible, horsepower rated, heavy duty if fused, general duty if unfused, designed for locking in "ON" or "OFF" position, in code gauge steel cabinets, as required by the application and the NEC.

B. Use switches which have number of poles required, dependent on equipment requirements.

C. Use NEMA 3R switches where exposed to weather, with weatherproof threaded hubs for top or side conduit entries into switch.

D. Use fuse clips which are rejecting type to accept Class RK or L fuses only.

E. Identify switches, as to equipment served, with engraved laminated plastic plates. Refer to Electrical Identification section of this specification.

2.02 FUSES

A. Furnish fuses manufactured by Buss, or equal, in accordance with the following:

1. Motors and Transformers and Lighting Loads, 0 to 600 Amp:
   a. 600 VOLT - Buss LPN-RK, UL Class RK1.

B. Size fuses specifically recommended by motor or equipment manufacturer.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install disconnect switches for motor driven appliances, motors, and motor controllers within sight of the controller position unless otherwise indicated.

B. Install fuses as indicated, in accordance with recognized industry practices to ensure that products serve the intended function.

C. Install safety switches on unitary equipment, adjacent to conduit entry, and in such a manner as to not interfere with the operation of, or access to the equipment. Disconnect and safety switches shall not be mounted on the building exterior wall. Paint safety switch to match equipment where exposed to view.

END OF SECTION 262425

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 264313 - SURGE PROTECTIVE DEVICES (SPDs)
LOW VOLTAGE AC SURGE PROTECTION FOR ELECTRICAL DISTRIBUTION SYSTEMS

PART 1. - GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers. Refer to related sections for surge requirements in:

1.02 RELATED SECTIONS

A. Section 262400 – Switchboards, Panelboards, and Enclosures

B. Section 262405 – Integrated Facilities Switchboards

1.03 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

B. SUBMITTALS – For Review/Approval

C. The following information shall be submitted to the Engineer:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

D. Where applicable the following additional information shall be submitted to the engineer:

1. Descriptive bulletins
2. Product sheets

1.04 Submittals – for Construction

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process.

1.05 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2. - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Cutler-Hammer

B. Square-D

1. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date

2.02 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

5. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

MODES	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
    a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
        (1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
        (2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
        (3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights

must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

d. ∃Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

(1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection

a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.03 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.04 Lighting and Distribution Panelboard Requirements

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
6. The SPD shall be of the same manufacturer as the panelboard.
7. The complete panelboard including the SPD shall be UL67 listed.

B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)

1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

C. Switchgear, Switchboard, MCC and Busway Requirements

1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus

plug at the assembly point by the original equipment manufacturer

4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.05 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)
3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3. - EXECUTION

3.01 EXAMINATION

3.02 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.03 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.04 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION 264313

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 265113 - INTERIOR BUILDING LIGHTING

PART 1. - GENERAL

1.01 RELATED DOCUMENTS

A. 265200 – Central battery emergency lighting and exit sign system.

1.02 DESCRIPTION OF WORK

A. The extent of building lighting fixture work is indicated on the drawings and in schedules, and by the requirements of this section.

B. The types of building lighting fixtures required for the project may include the following:

1. Light Emitting Diode (LED)

C. The applications of building lighting fixtures required for the project are shown in fixture schedules on the drawings and in these specifications and shall include the following:

1. General lighting
2. Task lighting

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

C. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:

a. All warranties, guarantees and manufacturer's direction on equipment and material covered by the Contract
b. Approved fixture/equipment brochures
c. Copies of approved Shop Drawings
d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
e. Any and all data and/or plans required during construction.
f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
g. The first page or pages shall have the name, addresses and telephone numbers of the following; General Contractor and all sub-contractors, Major Equipment Suppliers.

D. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

E. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

F. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction, coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

PART 2. - PRODUCTS

2.01 BUILDING LIGHTING FIXTURES

A. Acceptable Manufacturers:

1. Lithonia (and subsidiary fixtures)
2. Cooper (and subsidiary fixtures)
3. Day-Brite (and subsidiary fixtures)
4. Hubbell (and subsidiary fixtures)
5. Cree (and subsidiary fixtures)
6. Others that are specified elsewhere within the contract documents.
7. All others manufacturers by written approval no later than ten days prior to proposal date.

B. **Refer to the Light Fixture Schedule / Legend/ Details for all fixture specifications.**
Provide lighting fixtures, of the size, type and rating indicated: Complete with, but not necessarily limited to, lamps, lamp holders, reflectors, ballasts, starters and wiring.

C. LED POWER SUPPLIES / DRIVERS:

1. LED power supplies shall operate LEDs within the current limit specification of the manufacturer.
2. Shall operate from 60 Hz input source and have input power factor >90% and a minimum efficiency of 70% at full rate load of the driver.
3. Shall have short circuit and overload protection.
4. Shall have a minimum starting temperature of 0◦F and a maximum case temperature rating of at least 70◦F
5. Power supply output shall be regulated to ±5% across published load range.
6. Shall have as Class A sound rating.
7. Shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47CFR part 15, non-consumer (Class A) for EMI/RFI.
8. Shall contain no PCBs.
9. Shall carry a five (5) year minimum warranty from date of manufacturer against defects in materials or workmanship, including a replacement for operation at or below the maximum case temperature specification. For LED lamps and internal power regulation components for defects resulting in a fixture lumen depreciation >30%.
10. Dimmable power supplies shall allow the light output to be maintained at the lowest control setting (prior to off) without dropping out.

D. Lamps:

1. LED source packages, arrays or modules and power supplies shall be tested in accordance with LM-79-08. LED light source packages, arrays or modules shall be tested in accordance with LM-80 depreciation test and L70 rated life result shall be a minimum of 50,000 hours. LED lamp color temperature of 4000K with minimum 80% CRI is required for LED lamps. Lamp lumen minimum values as scheduled. Luminaire power factor shall be minimum 90%.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install building lighting fixtures of the types indicated where shown, in accordance with NEMA standards and requirements of the National Electrical Code pertaining to installation of interior lighting fixtures and with applicable portions of NECA's "Standard of Installation".

B. If a type designation is omitted, furnish fixture of the same type as is shown for rooms of similar usage. Verify before purchase and installation.

C. Check the building electrical system requirements and architectural finishes, and regardless of the catalog number prefixes and suffixes shown, furnish fixtures with the proper trim, frames, supports, hangers, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with said conditions.

D. Fixtures shall be supported to structural members of the building and shall not be supported solely by ceiling tiles, plaster or sheet rock.

3.02 ADJUST AND CLEAN

A. Upon completion of the project, the contractor shall clean all fixtures, inside and out, including plastics and glassware, adjust all trim to properly fit adjacent surface, replace broken or damaged parts, and lamp and test all fixtures for electrical as well as mechanical operation. Incandescent type fixtures shall be relamped with new lamps.

B. The contractor shall aim fixtures which require aiming, such as track lights, wall washers, etc., at the direction of or in the presence of the Owner's representative.

C. Protect installed fixtures from damage during the remainder of the construction period.

END OF SECTION 265113

SECTION 270528 - TELEPHONE AND DATA SYSTEMS ROUGH-IN

PART 1. - GENERAL

1.01 DESCRIPTION OF THE WORK

A. The extent of the work for telephone system rough in is indicated by drawings and schedules, and by the requirements of this section.

B. Each such system shall be provided with a separate conduit raceway system such as required for power and lighting systems.

PART 2. - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Telephone/Data equipment boards; ¾" thick plywood attached to wall. Size board as shown on drawings.

B. Telephone/Data outlet boxes shall be 4" x 4" trade size with single outlet plaster extension.

C. Wall plates installed over telephone outlet boxes shall be solid.

D. Wall plates are not required over telephone outlet boxes.

E. Refer to Electrical Raceways section of the specifications for types of conduits.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install 3/4” conduit, minimum, from each telephone systems outlet to as shown or scheduled on drawings. Conduits shall be appropriate for the purpose, and as otherwise required or permitted in electrical raceways section of the specifications.

B. Conduit bends shall be of minimum radius required by the telephone, systems company for the size of conduit involved.

C. Install 50 pound nylon pull cord in each raceway.

D. Provide grounding wire at telephone systems board. Extend #6 stranded copper from each cabinet or each board to nearest to panel providing power source. Leave 12" pigtail at telephone systems board for use by telephone systems installer. Install ground in conduit where subject to physical damage or where concealed in finished construction.

END OF SECTION 270528

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 275116 – PUBLIC ADDRESS & CLASSROOM INTERCOM SYSTEMS

PART 1. - GENERAL

1.01 DESCRIPTION

A. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, wiring, speakers, and all other necessary equipment to provide a complete operating system as indicated with the contract documents. Provide all necessary wall plates, specialty boxes, etc., not provided by others.

B. The intent of this specification is to maximize communications between the classroom and administrative areas utilizing VoIP Technology while enhancing school safety and reducing maintenance, operational, and installation cost.

C. Under this specification, the system shall provide a complete VoIP Communication System for Administrative, Classroom, Cafeteria, Library, Common, and Recreational areas.

D. The Communication System shall provide Voice Over IP distribution of intercom, overhead paging, emergency paging, class change times tones, emergency tones and program material.

Basis of Design is **IP6000 by Valcom.**

1.02 RESPONSIBILITIES

A. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.

B. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items may include hardware, rack panels, IDF racks, 66 Blocks etc., and other devices that are required for installation.

C. Labor furnished shall be trained and experienced in telecom/network systems.

D. All equipment unless otherwise specified, shall be new, free from defects, and the best craftsmanship in its class.

E. All manufactured equipment shall be installed as recommended by the manufacturers, or as indicated in their published installation manual.

F. Furnish and install necessary equipment, back boxes, supports and enclosures.

G. Furnish and install all necessary structured cabling as needed from IDFs.

H. Furnish Network connectivity, i.e. fiber, cat 5/5e/6 for distribution of the intercom system.

I. Furnish shop drawings.

J. Perform initial programming of system and audio level adjustments.

K. Perform final programming of system and audio level adjustments.

L. Provide system documentation including equipment manuals and drawings.

M. Guarantee all equipment and components for their specified period from date of acceptance.

N. Provide information on system requirements to any Contractor responsible for supplying related l materials for this system.

O. System must be U.L. 813 and FCC Part 15 listed for safety reasons. Systems not listed as above shall not be acceptable.

1.03 SUBMITTALS

A. Submit layout drawings of the communication system and all components.

B. Submit documentation on the Network requirements that are needed for proper installation and distribution.

C. Submit drawings of control equipment showing all major components and positions in the rack.

D. Provide block diagrams showing components and relative connections. ‘

E. Submit a certificate showing a completion of installation, programming, and service training from the system manufacturer.

F. Submit data sheets on equipment provided.

1.04 QUALIFICATIONS

A. The Contractor shall be from an established and local company providing solutions to the school market for a minimum of 3 (three) years with Telecom/Data/Network Experience.

B. The Contractor shall maintain an adequate parts inventory to perform necessary service and upgrades.

1.05 MAINTENANCE

A. The Contractor shall provide a 24 (twenty four)-month guarantee of the installed system against defects in material and workmanship. All warranty material shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by the Owner or Engineers.

1.06 PLEDGE OF QUALITY

A. The Contractor shall be an authorized dealer of the supplied equipment with full warranty privileges.

B. The Contractor must have attended the Manufacturers Training Program.

C. The Contractor shall inventory the necessary parts in order to maintain and service the equipment being supplied. This equipment inventory level shall be in direct proportion to total systems installed as recommended by the manufacture,

D. The Contractor shall provide complete drawings detailing all interconnections, panel wiring diagrams, Network connections, and specification sheets.

1.07 IN-SERVICE TRAINING

A. The Contractor shall furnish in-service training with the system. The sessions shall facilitate the training of personnel in operating classroom equipment, administrative equipment, program distribution, and user programming functions. System specific customized user manuals shall be provided at the time of training.

1.08 WIRING

A. Wiring shall be in accordance with the Manufacturers specifications. Wiring shall meet all local and state codes. All wiring shall be ground and short tested. All wiring shall be Cat 5/5e/6 for connections to speakers, call switches, etc.

1.09 NETWORK INTERCOM DISTRIBUTION

A. VCRCA Network Requirements for shared network installation

1. Shall be VLAN capable 10/100 Ethernet switches with Gig fiber backbone
2. Shall create a port based VLAN on the network and install the RCA cards on that VLAN
3. Fully enabled multi-casting on network

B. VCRCA Network Requirements for dedicated network installation

1. Shall be 10/100 Ethernet switches with Fiber Backbone
2. Shall plug VCRCA card into Ethernet Switch and Fiber backbone shall plug-in via Gig Ethernet interface modules. Alternative installation shall be VCRCA cards plugged into Ethernet Switch and Fiber backbone shall utilize media converters from Ethernet switch ports.

1.10 COMMUNICATION SYSTEM

A. The Communication System shall provide at least the following functions and features:

1. The ability to be distributed via a fiber 10/100 switched, VLAN enabled network or 10/100Switched standalone intercom network. It shall be possible to eliminate the need for copper feeder cables between the Main and Intermediate distribution frames through the use of fiber optics. Fiber optic connected IDFs shall be capable of serving up to 360 zones of intercom/paging and shall feature the ability to support clock correction and/or door relay control signals from any other fiber optic connected IDF in the system.
2. Shall have H.323 and/or SIP, or FXO Port Integration to connect all talk paths to the VoIP phone system of choice. This integration shall give the phone system vendor the option of utilizing the Call Manager Resource Tool to manage all ports connected to and from their system.
3. Direct dialed, hands-free, two-way communication from all administrative telephones to any location equipped with a talkback speaker.
4. Automatic gain control on intercom speech to assure constant talkback speech level. o
5. Voice Over IP Integration and distribution microprocessor based system capable of handling up to 720 points (seven hundred twenty). A point is defined as a call-in switch or a speaker output. 3
6. System shall be modular in design and capable of expanding in increments of 48 points allowing for budget flexibility and expandability.
7. System shall interface with any VoIP telephone system, utilizing H.323, SIP, or FXO Port type integration thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon

any selected telephone system, and is not H.323 or SIP or FXO Port interfaced shall not be acceptable.

8. Automatically sound a tone or play a pre-page WAV file over any loudspeaker connected for two-way communication to alert the classroom teacher that this two-way call has been established. This is intended to prevent unauthorized monitoring. The privacy tone must repeat every 15 Q (fifteen) seconds.
9. Distribution of emergency announcement(s) from any authorized telephone to all areas A furnished with a loudspeaker. Emergency announcements shall have the highest system priority.
10. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, multiple group call, or dial-on-the-fly page groups.
11. Classroom speakers shall be software assignable to any or all of 72 (seventy-two) paging groups.
12. Provide the ability to define and archive unlimited time tone schedules with up to 255 events per schedule. Each scheduled event shall be capable of controlling any one of 5 (six) internal tones; user selected custom audio/voice phrases, audio from any of 3 auxiliary sources or up to 40 relays for building control. Each scheduled audio event shall be distributable to up to 72 audio groups. The system shall feature the ability to automatically initiate up to 8 schedules per day, based upon the day of the week or calendar dates up to one year in advance. Up to 8 daily schedules shall operate simultaneously, Schedule administration, modification and creation functions must be available through administration PC software. Systems that do not allow the school to manage their own schedules with PC software do not offer calendar based scheduling up to one year in advance or require separate page and time groups shall not be acceptable.
13. Provide 1, 2, 3 or 4 digits numbering plan, thus allowing the classroom speaker and the, classroom telephone to be the same architectural number.
14. Provide facilities for up to 7 (seven) call-in priority levels. Each classroom call button shall be assignable to any one or two of these priority levels. The call button priority levels shall have the capacity to change state on a time of day basis. The priority levels shall be as follows:
    a. Normal
    b. Security
    c. Normal/Emergency
    d. Urgent/Emergency
    e. Overhead Ring
    f. Emergency Only
    g. Ignore
15. Call button priority levels shall determine call queue placement. Emergency calls will be answered first; urgent calls second and normal calls last.
16. System shall be capable of placing intercoms call on hold in order to perform other administrative functions.
17. Any classroom/area loudspeaker must have the flexibility to be programmed as a testing room. A testing room shall be excluded from receiving general announcements, class change tones, group announcements and program material. The testing room must receive emergency tones and announcements. A dial code must be provided that will access these testing rooms at the same time, allowing for an announcement to the testing rooms for applications such as standardized testing. The testing rooms may be reactivated to normal operation at any time by the administration staff as needed. Testing rooms shall automatically be reset to normal operation before start of class the next day.
18. Programmable features shall be stored in non-volatile memory and shall not be lost due to power failures.

19. Classroom initiated intercom calls must be able to be assigned to ring at specific administrative V ports. These administrative ports shall have the flexibility to be forwarded to other administrative ports should a call go unanswered or should the assigned administrative port be busy.
20. Facilities to annunciate incoming intercom calls at multiple administrative phones simultaneously. Calls may be answered from any of the administrative telephones by simply lifting handset, dialing the room number or pressing a button on telephone. Once answered, the call will automatically be cancelled for other administrative phones.
21. System functionality must include the capability to manually distribute up to 5 (five) alert emergency tones via pushbuttons, contact closure, or dial up tones from any administrative telephone. These tones shall be customizable with respect to cadence, type and duration. Dial up tones must only be accessible by authorized users.
22. The system must provide a minimum of 4 (four) ports to be connected to the telephone system via H.323, SIP, or FXO Port integration from the intercom system. These 4 (four) intercom lines shall provide built-in Enhanced Caller Line Identification which will visually announce the name of the teacher or location, the architectural classroom number, and the status of the call-in level thus allowing interfacing to any Voice over IP telephone system. Intercom systems that require connection via trunk loop start ports to a VoIP telephone shall not be acceptable.
23. The system shall have the ability to control all system relays. Relays shall be controlled through the administrative software, DTIVIF controlled, automatically cycle at a programmed time of day, follow time schedule events, follow audio group events, follow security calls, and follow emergency and ADA calls. All relays must be software programmable with the flexibility to change as required.
24. The system shall provide at least three simultaneously operating, non-restrictive program distribution channels. The audio program material shall be controlled and distributed with administration PC software allowing simple and easy changes. Systems that require manual operated switch-banks or cumbersome DTMF telephone codes for distribution shall not be acceptable.
25. The Communication System shall feature voice call progress. When 2 or more system users attempt to announce into the same area, the unsuccessful user shall be notified via a voice message. When a user’s announcement attempt is overridden by a higher priority announcement, the overridden user shall be notified via a voice message.
26. The system shall have the ability to store WAV files directly onto the CPU and shall not be lost due to power outage.
27. The WAV files shall be activated via the Administration Software, Telephone and/or Telephone system, and/or pushbuttons.
28. The WAV files shall be programmable as to what level of priority they can be broadcast. They shall be programmable as to override any class change tones, normal all call, music, and intercom in the event of an emergency.
29. The WAV files shall also have the ability to be broadcast into any one or all of the 72 audio groups as well to any zone within the system
30. The WAV files shall be have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.
31. The WAV files shall be able to be broadcast via a pushbutton. When this pushbutton is activated it shall be programmable to select which WAV file is broadcast, the priority level, where it is broadcast, and how many times it shall play.
32. The WAV files shall also have the ability to be a part of the class change tones within the system. These files shall be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.
33. The WAV files shall be programmable as to replace the hands—free alert tone, repeated alert tone, or the all call alert tones.

PART 2. - PRODUCTS

2.01 INTERCOM CONTROL UNIT

A. Shall be SIP Integrated to the Voice Over IP telephone system. VALCOM VE8090R.

B. Shall utilize a shared data network (VLAN enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones.

C. Shall be capable of accessing remote classrooms (trailers, temporary classrooms etc.) via IP Talkback Speakers. This shall provide intercom, class change tones, emergency tones, and normal / emergency paging via a wireless or wired network to these remote locations. `

D. Shall be capable of expanding to 720 (seven hundred twenty) points. A point is defined as a call-in switch or speaker output.

E. Provide pre-alert tone to classroom for intercom calls and general announcements.

F. Ability to program and control the built-in master clock with unlimited events and unlimited time schedules with multiple audio groups. ,

G. Ability to produce user defined tone signals for time tones or emergency tones.

H. Ability to control wireless or wired clocks (various correction methods).

I. Ability to select the tone on an all-call basis from any, or selected, administrative telephones.

J. Provide an RS-232 and Ethernet port, which will give ability to monitor operations and functions of the systems.

K. Provide off-site programming and diagnostics of the system. it shall also be capable of determining basic circuit faults.

L. The system shall be capable of simultaneous conversations between administrative ports.

M. The system shall have a Windows° based PC administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, time updates, holiday schedules and day/night mode operation from their desktop PC. Systems that require propriety consoles, special LCD displays or solely utilize DTMF for changes to perform these functions shall not be acceptable.

N. System shall provide calendar based scheduling up to one year in advance.

O. The system shall be programmable via Ethernet or direct COM port cable connection.

P. System shall be capable of utilizing 45 (forty-five) ohm or 25-volt speakers for classroom type speakers. Systems that require re-tapping existing classroom 25-volt speakers shall not be acceptable.

Q. System speakers shall be capable of utilizing standard CAT 5/Se/6 infrastructure for installation from the Intermediate Distribution Frames only to the classroom and/or zone, thus allowing for only one type of wiring infrastructure within the school. Distribution of all voice signaling shall utilize a shared or dedicated network utilizing the Valcom IP6000 Network Intercom Expander. This Network Expander shall be a 19" rack mounted package installed in all IDFs as required

for Network distribution of all features as listed herein. Systems that require homerun, dedicated, 18 gauge shielded wiring shall not be acceptable.

R. Provide 8 (eight) unrestricted audio paths for communication between administrative phones, program material, time tone distribution, and paging.

S. Provide 6 (six) software programmable pushbutton inputs that can be used to activate tones, emergency tones, time tones, schedules, set system time, foroe a holiday schedule, door entry, etc.

T. Provide 8 (eight) software programmable output contact closures which can be activated manually to turn on cameras, unlock doors, emergency lockdown, etc., or automatically via Master Time Control Center.

U. Provide voice synthesized call-in, which allows the administrative telephones to hear the incoming intercom calls room number over the handset.

V. Provide call confirmation tone at speaker when an intercom call is placed. This verifies that the call has been placed in queue. If the call is upgraded to an emergency, a second confirmation tone shall be activated.

W. Automatically announce the architectural room number over any one, group, or all speakers if an emergency call-in goes unanswered. Systems that do not announce emergency call-ins shall not be acceptable.

X. Provide Emergency Override On Board Voice Messaging via the following methods:

1. Any authorized PC on the schools LAN/WAN
2. Any authorized telephone
3. Any pushbutton

2.02 VOICE OVER IP TELEPHONE INTEGRATION

A. All admin access path ports shall be integrated via H.323, SIP, or FXO Port type protocol. This integration shall be seamless and easy to meet all standards as set forth in H.323, SIP, or FXO Port type Interfacing. The VoIP Phone System Call Manager shall be used to manage these ports for control and management thus reducing adds, moves, and change cost.

B. It shall be possible without the cost of additional hardware/software to incorporate a WAN/LAN district wide paging system by means of the built in VoIP district Paging Adapter. This adapter shall give the district the ability to page each school independently, as a group of schools, or all schools where a Class Connection IP system is installed.

2.03 DISTRIBUTION

A. For a shared network the requirements shall be a VLAN capable 10/100 Ethernet switched with Gig fiber backbone. The recommended installation shall be to create a port based, fully enabled multicasting, VLAN on the network and install the VCRCA Network Intercom Extender on that VIAN.

B. For a dedicated network the requirements shall be a 10/100 Ethernet switched fiber backbone. The VCRCA Network Intercom Extender shall plug into the Ethernet switch and fiber backbone via plug-in Gig Ethernet interface modules. There shall also be an alternative installation where the VCRCA Network Intercom Extender plugs into the Ethernet switch and a fiber backbone via media converters connected from Ethernet switch ports.

2.04 IDF WIRING

A. All wiring shall be listed for the intended purpose. The cabling shall Cat5/5e/6 for all connections from the IDF to the classroom and or zone origination point. All classrooms shall be homerun to each local IDF that serves that area. There shall be no cabling required from the IDF to the MDF as this is accomplished through the shared or dedicated network devices and infrastructure. All interior wiring shall be in accordance with new construction guidelines suggested by the Manufacturer; including the speaker and the call-in switch.

2.05 REMOTE CLASSROOM WIRING

A. The VALCOM IP6000 Device (RID) shall provide connection for a talkback speaker and call in switch in a remote classroom location. This device shall provide intercom, class change tones, emergency tones, and normal / emergency paging via a wireless or wired network to these remote, locations.

2.06 INSTALLATION

A. Complete system shall be installed in accordance with Manufacturers recommendations.

B. All wiring shall be installed in raceways or plenum rated cable where routed in plenum ceiling areas.

2.07 PROTECTION

A. The contractor shall provide all necessary protection on the AC power feed and on all station lines leaving/entering the building.

B. The contractor shall note in his system drawings, the type of protection devices and all relative information.

C. **Adherence to Specifications / Equivalent Brands:**

1. Specifications in this Request for Proposal may have been identified, described and referenced by a brand name or trade name/mark that is intended to be descriptive, but not restrictive, and is used to indicate the quality and characteristics of products that may be offered. Other products may be considered for award if such products are clearly identified and include such information as necessary to provide adequate basis for determining the quality and functional capabilities of the product being offered detailing the reason(s) why and how the proposed items will meet the specifications and not be considered an exception, and submit adequate information to document this claim. The Glynn County School System reserves the right to be the sole judge of what is equal or equivalent. Proposals which do not comply with these requirements are subject to rejection. If you fail to name an alternate brand it will be assumed that you are proposing, and will be required to furnish, goods identical to the proposal standard. The Glynn County School System reserves the right to request product demonstrations and/or samples from any Proposers prior to proposal award. Failure to provide data or product demonstrations/samples may be considered valid justification for rejection of proposal.
2. **Samples** of items, when required, must be furnished free of expense, prior to the opening of proposals, and if not destroyed, will upon request be returned at die Proposer’s expense. Request for the return of the samples must be made within ten (10) days following the opening of proposals. Each individual sample must be labeled with the Proposer’s name and address.

2.08 SPEAKER LOCATIONS:

A. Refer to plans for speaker locations.

B. Speaker Types:

1. S1 – Classroom areas, 1-way, ceiling mount.
2. S2 – Office areas, 1-way, ceiling mount.
3. S3 – Corridor areas, 1-way, ceiling mount.
4. S4 – Open Areas, 1-way, recessed wall mount, or ceiling mount. Coordinate with plans.
5. S5 – Exterior – 1-way, recessed exterior wall mount.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install system and materials in accordance with manufacturer's instructions and roughing in drawings, and details on the drawings. Install electrical work and use electrical products complying with requirements of applicable Division 27 sections of these specifications.

B. The term "wiring" is defined to include the providing of wire, conduit and miscellaneous materials as required for mounting and connecting the electrical devices. All wiring and devices shall be fully concealed unless otherwise approved by Engineer.

C. Provide multi conductor instrument harness bundle in place of single conductors where a number of conductors can be run along a common path. Fasten flexible conductors bridging cabinets and doors neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. All Devices in Activity rooms, Gymnasiums, Swimming pools, Field Houses and other similar use areas shall be suitably protected with substantial wire guards, not less than 11 gauge, and 1" x 2" mesh.

E. Number code or color code conductors, appropriately and permanently for identification and servicing of system.

F. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

3.02 FINAL INSPECTION:

A. 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.

3.03 INSTRUCTION:

A. 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.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.04 ZONES

A. Zones shall be identified and scheduled on the Shop Drawing Submittal.

3.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

3.06 IN-SERVICE TRAINING

A. The contractor shall provide a minimum of twelve (12) hours of in-service training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

3.07 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Integrated Electronic Communications system.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.08 INSTALLATION

A. General:

1. Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:

1. Install wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces, and in gypsum board partitions, where cable-wiring method may be used. Use UL listed plenum cable in environmental air spaces including plenum ceilings. Conceal wiring except in unfinished spaces.

C. Impedance and Level Matching:

1. Carefully match input and output impedance’s and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring:

1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
2. The contractor shall mount a main distribution frame behind the Integrated Electronic Communications Network console. All wires shall be laid down on terminal punch blocks and identified by the actual room location it serves. All the communications points shall be wired into this main distribution frame, laid down in sequence, and identified by which line it is on and the point position it serves.
3. All housings are to be located as specified and shown on drawings.
4. Make installation in strict accordance with approved manufacturer's drawings and instructions.

5. The contractor shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

E. Wiring Within Enclosures:

1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
2. Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other Integrated Electronic Communications Network system conductors.

F. Splices, Taps, and Terminations:

1. Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets and equipment enclosures.

G. Identification of Conductors and Cables:

1. Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

H. Speakers:

1. Provide mount for speaker suitable for surface to be mounted in.
2. For speakers located in lay-in ceilings, provide independent t-bar support, do not support speaker from ceiling tile or grid.
3. For wall mounted speakers, provide manufacturers companion back box, recessed in wall. Verify painting requirements with architect.
4. For exterior speakers, provide manufacturers companion back box, recessed in wall. Verify painting requirements with architect.
5. For speakers located within the Gym, provide heavy duty wire guards.

I. Weatherproofing:

1. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

J. Repairs:

1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.09 GROUNDING

A. Provide equipment-grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

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 in his system drawings, the type and location of these protection devices as well as 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.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection:

1. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.11 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of 16 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

3.12 OCCUPANCY ADJUSTMENTS:

A. When requested by the Architect within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.13 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 275116

SECTION 283100 - FIRE ALARM MULTIPLEX SYSTEMS (PERFORMANCE SPECIFICATION)

PART 1. - GENERAL

1.01 DESCRIPTION OF THE WORK

A. **Contractor to design and provide all equipment, accessories, and materials in accordance with the contract documents to provide a complete and operating system. System to be designed in accordance with all applicable codes including local ordinances, by an experienced and licensed Fire Alarm designer. Any device type / location indicated on the plans is indicated for design intent only.**

B. This section of the specification includes the final design, furnishing, installation, connection and testing of the microprocessor controlled, analog addressable intelligent fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies and wiring as shown on the drawings and specified herein. The extent of fire alarm system work is shown on drawings and in schedules, and is hereby defined to include furnishing and installing of a system with the following sequence of operation:

1. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes fire alarm signaling devices, sounding a non-coded alarm, providing zone identification at the fire alarm control panel and annunciator panels.
2. Services for Outside Monitoring by Glynn County School District under separate contract.

C. The contractor shall be an authorized provider and installer of the specified equipment, and shall be knowledgeable and experienced in work of a similar nature to determine the extent of the work required, and to prepare shop drawings illustrating the extent of the work to be undertaken, and to pursue the work of the Fire Alarm System installation. The contractor shall review the Architectural, Plumbing, Electrical, Mechanical and Fire Alarm Drawings to fully understand the scope of work. The contractor shall supervise, release, engage and/or monitor all devices required by Code or Local Authority whether specifically indicated on drawings or addressed in specifications.

D. Sub-contracting of the fire alarm system or system components is not allowed. Responding proposer shall provide approved manufacturers certification with proposal.

E. Provide for the design and installation of the fire alarm system, with suggested minimum device coverage as indicated. Additional devices may be required for NFPA approved coverage based on existing conditions not known at the time of issue.

F. Required system features:

1. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be supervised either electrically or by software-directed polling of field devices. The system shall also be listed by Underwriter's Laboratories under the category of Control Unit System (UOJZ) and Control Unit Accessories (UOXX).
2. Multiplex communication conductors.
3. Control of auxiliary devices, such as fan shut down, etc.
4. Battery standby system – 24 hour.

5. Remote station annunciator contacts.
6. Microprocessor based monitoring and control system.
7. Multiplex communication conductors. (Class A)
8. Remote station annunciator., refer to drawings for location(s)
9. The system shall be 100% field programmable without the need for external computers or PROM programmers, and shall not require the replacement of memory IC's.
10. Provide integrated dialer for outside monitoring of facility.
11. Interface to Kitchen Hood Fire Extinguishing System.
12. Interface to Fire Doors and associated release mechanisms.
13. Door Hold Open devices and release mechanisms.
14. Provide integrated UDAC for Outside Monitoring to transmit system status Monitoring Service.
15. Voice evacuation (where required by local authority).

G. System shall consist of the following components or their functional equivalents:

1. Microprocessor based central processing unit.
2. Remote Annunciator Panels. (quantity as indicated on plans)
3. Annunciator.
4. Automatic detecting devices.
5. Manual devices.
6. Alarm and warning devices.

H. Fire alarm system shall be expandable by the addition of the required modules to the basic system.

I. Each zone shall consist of not more than eight manual or automatic devices.

J. Auditorium or public assembly zones shall be capable of individual switching in the projection booth, stage area, or other designated area to comply with appropriate sections of NFPA 101 regarding assembly occupancies.

K. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

L. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

1.02 SCOPE OF THE WORK

A. An intelligent reporting, microprocessor controlled fire detection and emergency alarm communication system shall be installed in accordance with the specifications and drawings.

B. The system shall be designed such that each signaling line circuit (SLC) shall be limited to only 80% of its total capacity used during the initial installation.

C. The FACP and peripheral devices shall be manufactured 100% by a single manufacturer (or division thereof).

D. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.03 PERFORMANCE

A. Alarm and trouble signals shall be digitally encoded by listed electronic devices onto an NFPA Style 6 looped multiplex communication system.

B. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Style 6 Signaling Line Circuits.

C. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).

D. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).

E. Digitized electronic signals shall employ check digits or multiple polling.

F. Power for initiating devices and notification appliances must be from the main fire alarm control panel to which they are connected.

G. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

H. 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.

I. Horn circuits and control equipment shall be arranged such that loss of any one (1) horn circuit will not cause the loss of any other horn circuit in the system.

1.04 SYSTEM OPERATION

A. 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.
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.
4. 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 notification appliances and/or relays) shall be activated.
5. The audio portion of the system shall sound the proper signal to the appropriate zones.

1.05 QUALITY ASSURANCE

A. Provide fire alarm system produced by one of the following manufacturers:

1. **Silent Knight – <u>Farenhyte Line Only</u>**
2. **GE**
3. **Notifier**
4. **Gamewell-FCI by Honeywell**
5. Other approved equal. Must be approved in writing by Engineer prior to Bidding.

B. Provide electrical products which have been tested, listed and labeled by Underwriters' Laboratories, Inc., and which comply with NEMA Standards.

C. The National Fire Protection Association publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Use current locally adopted editions of the standards.

1. No. 72A Local Protective Signaling Systems.
2. No. 72D Proprietary Protective Signaling Systems.
3. No. 72E Automatic Fire Detectors.
4. No. 90A Installation of air conditioning and ventilating systems.
5. No. 101 Life Safety Code.

D. The contractor furnishing and installing the equipment shall show satisfactory evidence with the shop drawings that they maintain stocks of replacement parts, and maintain a service department which is fully capable of maintaining the equipment.

E. Fire alarm systems shall be installed by an agent having a current certificate of registration with the State Fire Marshal's Office of the Georgia State Board of Insurance, in accordance with state law. A "Fire Alarm Installation Certificate" shall be provided as required by the Office of the State Fire Marshall.

F. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

G. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
   a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract
   b. Approved fixture/equipment brochures
   c. Copies of approved Shop Drawings
   d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   e. Any and all data and/or plans required during construction.
   f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.

g. The first page or pages shall have the name, addresses and telephone numbers of the following; General Contractor and all sub-contractors, Major Equipment Suppliers.

H. Training:

1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

I. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

J. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees as to the accuracy.
2. **The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage / phase / pressure / capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.**
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.06 SUBMITTALS

A. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout and main control panel module layout, configurations and terminations.

B. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

C. Software Modifications

1. 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.

D. Certifications:

1. 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.

PART 2. - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. 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.

B. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

C. 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.

D. The main fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.02 MAIN FIRE ALARM CONTROL PANEL AND FIRE COMMAND CENTER:

A. The main FACP Central Console shall be a **SILENT KNIGHT IFP 2000** and shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, Remote Annunciator Panels. **Silent Knight 5828 is not considered equal to the IFP-1000, and will not be approved.**

1. **Contractor must be an approved Silent Knight Farenhyte ESD – Dealer/Installer, and shall submit current Farenhyte Dealer credentials with product data submittal documents**

B. The main FACP and Central Console 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 Remote Annunciator Panels.
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 terminal, panel display, and annunciators.
    a. 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 audible device in the control panel shall sound a distinctive signal.
        (3) The 80-character backlit 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.
        (4) All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
    b. When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
        (1) The system trouble LED shall flash.
        (2) A local piezo-electric audible device in the control panel shall sound a distinctive signal.
        (3) The 80-character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
        (4) All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.
    c. When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
        (1) The system trouble LED shall flash.
        (2) A local piezo-electric audible device in the control panel shall sound a distinctive signal.

(3) The 80-character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
(4) All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

C. System Capacity and General Operation

1. The control panel shall be capable of expansion of devices for a maximum system capacity of 1016 addressable points. The system shall be capable of 1016 annunciation points per system regardless of the number of addressable devices.
2. The fire alarm control panel shall include a full featured operator interface control and annunciation panel which shall include a backlit 80-character liquid crystal display, individual, color coded system status LEDs, and an alpha-numeric keypad for field programming and control of the fire alarm system.
3. The FACP shall provide the following features:
   a. Block Acknowledge for Trouble Conditions.
   b. Rate Charger Control.
   c. Control-By-Time (Delay, Pulse, time of day, etc.).
   d. Automatic Day/Night Sensitivity Adjust (high/low).
   e. Device Blink Control (turn of detector LED strobe).
   f. Environmental Drift Compensation (selectable ON or OFF).
   g. Smoke Detector Pre-alarm Indication at Control Panel.
   h. NFPA 72 Smoke Detector Sensitivity Test.
   i. System Status Reports.
   j. Alarm Verification, by device, with tally.
   k. Non-Fire Alarm Module Reporting.
   l. Automatic NFPA 72 Detector Test.
   m. Programmable Trouble Reminder.
   n. Upload/Download System Database to PC Computer.
   o. One-Man Walk Test.
   p. Smoke Detector Maintenance Alert.
   q. Security Monitor Points.
   r. On-line or Off-line programming.
   s. Voice Evacuation (where required by local authority).

D. Central Processing Unit (CPU):

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 CPU shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. 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.
4. The main FACP central console shall be designed so as to permit continued local operation of Remote Annunciator Panels under both normal and abnormal network communication loop conditions. This shall be obtained by having Remote Annunciator Panels operate as local control panels upon loss of network communication.

5. The FACP and CPU shall be modular in construction to allow ease of servicing. The CPU and Remote Annunciator Panels shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems which require use of external programmers or change of EPROMs are not acceptable.
6. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients including RFI and EMI.
7. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU, Remote Annunciator Panels, and peripheral devices shall be reliable and error free. The transmission scheme used should employ dual transmission or other equivalent error checking techniques. Failure of any peripheral device to respond to an interrogation shall be annunciated as a trouble condition.

E. 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.
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), which 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

F. Loop Interface (Signaling Line Circuit) Board:

1. The SLC board shall monitor and control a minimum of 127 intelligent addressable devices.
2. The SLC interface board shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. The SLC interface board shall not require any jumper cuts or address switch settings to initialize operations.
4. The SLC interface board shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class A) circuit.
5. The SLC interface board shall be able to drive an NFPA Style 4 twisted shielded circuit up to 12,500' in length. The SLC Interface shall also be capable of driving an NFPA Style 4, no twist, no shield circuit up to 3,000' in length. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall not be allowed in either case.
6. The SLC 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 device. The SLC 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 the automatic determination of detector maintenance requirements.

G. Serial Interface Board (SIB):

1. The Serial Interface Board shall provide the EIA-232 interface between the fire alarm control panel and UL-Listed Electronic Data Processing (EDP) peripherals.
2. The Serial Interface Board shall provide one EIA-485 port for the serial connection of the optional annunciator and control subsystem components.
3. The SIB shall include LEDs which indicate that it is in regular communication with the annunciators and other EIA-485 connected peripheral devices.
4. All EIA-232 circuits shall be optically isolated and power limited.

H. Enclosures:

1. The control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

I. Power Supply:

1. The main power supply shall operate on 120 VAC, 60Hz, and shall provide all necessary power for the FACP.
2. It shall provide 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
3. It shall be expandable for additional notification appliance power in 3.0 ampere steps.
4. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. It shall charge 55 Amp Hour batteries within a 48 hour period.
5. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
6. It shall be power-limited per UL864 requirements.
7. It shall provide meters to indicate battery voltage and charging current.

J. System Circuit Supervision

1. The FACP shall supervise all circuits to intelligent devices, Remote Annunciator Panels, annunciators and peripheral equipment 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 which device or devices are not responding and print the information in the history buffer and on the printer.
2. Remote Annunciator Panels that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.
3. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.
4. All horn circuits shall be supervised for opens and shorts.

K. Field Wiring Terminal Blocks

1. For ease of service, all wiring terminal blocks shall be the plug-in/removable type and be capable of terminating up to 12 AWG wire. Fixed terminal blocks are not acceptable.

L. Printer

1. Printers shall be of the automatic type, printing code, time, date, location, category, and condition.
2. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desk top or table. The printer shall communicate with the control using an interface complying with Electrical Industries Association standard EIA-232D. The printer power shall be 120 VAC @ 60 Hz.
3. Thermal printers are not acceptable.
4. The system shall have a strip printer mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

M. Remote Annunciator Panel (Remotely Located Control Panel):

1. Remote Annunciator Panel shall be listed under UL category UOJZ as an independent, local fire alarm control unit as well as being listed as a critical component in a multiplex fire alarm system. Remote Annunciator Panels shall be located where shown on the plans. Silent Knight RA-1000.
2. Each Remote Annumciator Panel shall be powered from a local Power Supply, and shall provide all power necessary for its own operation, including standby power.
3. Remote Annunciator Panels shall communicate with, and be controlled by, the host Fire Alarm Control Panel via a 2-wire signaling line circuit (SLC). This SLC Loop shall operate as a NFPA Style 6 Loop.
4. Remote Annunciator Panel shall be used to house amplifiers, batteries and power supplies to allow a true distributed processing and amplification.
5. Each Remote Annunicator Panel shall have the following indicators and operator Controls:
   a. Alarm Acknowledge/Signal Silence/Reset Switch.
   b. Power LED.
   c. System alarm LED.
   d. System trouble LED.
   e. Local piezoelectric signal.
   f. Red alarm per Initiating Device Circuit.
   g. Green on/off LED per notification appliance circuit or relay.

N. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers or electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. It shall be possible to program through the standard FACP keyboard all standard functions.
3. All field defined programs shall be stored in non-volatile memory.
4. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual

on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.

5. The system programming shall be "backed" up on a 3.5" floppy diskette utilizing an upload/download program. This system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.

O. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

P. 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 FACP shall keep a count of the number of times 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. Detector Analog Value.
   g. All Program Parameters.
5. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and logged, listing all system statuses.
6. System History Recording and Reporting: The fire alarm control panel shall contain a History Buffer that shall be capable of storing up to 400 system events. Each of these events 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 which 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. 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.

8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personnel when a detector is at 80% of its alarm threshold in a 60 second period.

Q. Provide fire alarm system products in sizes and capacities indicated, complying with manufacturer's published product information on standard materials and components designed and constructed for applications indicated.

R. Provide required basic wiring materials as specified in Division 16 sections. Comply with manufacturer's instructions and recommendations.

S. Visual Devices: Provide manufacturer's standard construction fire alarm strobe, Silent Knight 5865 Series with flashing xenon light visual signal. UL listed to Standard 1971. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

T. Audible/Visual Combination Devices: Provide manufacturer's standard construction fire alarm horn/strobe, Silent Knight 5865 Series with horn and flashing xenon light visual signal. UL listed to Standard 1971.

U. Exterior Horn: Furnish and install weatherproof outside horn at locations as shown on drawings. Horn shall be placed near top edge of building, but not greater than 20' above finished grade. Horn shall be Silent Knight GMH-24 or approved equal. All exterior horns shall be provided with a suitable backbox to allow for recessed placement where practical.

V. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches.
2. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches. Devices which use a binary address or special tools for setting the device address, such as a dip switch are not an allowable substitute.
3. Detectors shall be analog and addressable, and shall connect to the fire alarm control panel's Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual (2) status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall 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 can be programmed off via the fire control panel program.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time-of-day basis.
6. Using software in the FACP, 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, Chapter 7.

7. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature.
8. The following bases and auxiliary functions shall be available :
   a. Sounder base rated at 85 DBA minimum.
   b. Form-C Relay base rated 30VDC, 2.0A.
   c. Isolator base.
9. 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.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).

W. Addressable Pull Box (Pullstation): Provide manufacturer's standard construction, red enclosure, manual fire alarm stations, double action semi flush mounting, Silent Knight SD500-PS, Addressable.

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75" or larger. Provide "Stopper II" with local audible alarm at each pullstation location. Provide "Weather Stopper II" with local audible alarm at exterior locations. (Verify with Each Authority Having Jurisdiction on acceptance of audible alarm on pull station covers.) Where allowed by Local Authority. Provide without audible alarm where audible alarm is not allowed.

X. Intelligent Photoelectric Smoke Detector: Provide manufacturer's standard construction automatic photoelectric type smoke detector, Silent Knight SD505-APS.

1. 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.

Y. Intelligent Thermal Detectors (Heat Detector)

1. Thermal detectors shall be intelligent addressable devices rated at 135E F and have a rate-of-rise element rated at 15E F per minute. It shall connect via 2 wires to the fire alarm control panel signaling line circuit, Silent Knight SD505-AHS.

Z. Door Holders and Closers:

1. Door holders, flush mounted standard hardware depth. Silent Knight FM998-120 or equal. Refer to electrical drawings for additional information and mounting locations.

AA. Intelligent Duct Smoke Detector: (Duct Detector) Provide manufacturer's standard construction automatic smoke detectors, duct type, with sampling tubes, Silent Knight SD505-

ADHR/DTS or equal, with auxiliary contacts for fan shut down as required. (Provided and installed by Fire Alarm Contractor, Addressable Device.)

1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

BB. Addressable Dry Contact Monitor 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) to one of the fire alarm control panel SLC loops. Silent Knight SD500-AIM or SD500-MIM.
2. The monitor module shall mount in a 4" square, 2-c" deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. 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. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-:" x 1-3" x 2". This version need not include Style D or an LED.

CC. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. Silent Knight Sd500-ANM.
2. The control module shall mount in a standard 4" square, 2-c" deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with 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 NACs 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.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

DD. 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. Silent Knight SD500-LIM.
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.
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" deep electrical box or in a surface mounted backbox. 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.

EE. Cable

1. **All cable shall be color red.**

2.03 BATTERIES AND EXTERNAL CHARGER:

A. Battery:

1. Shall be 12 volt, Gell-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free.
4. Final battery size to be calculated & confirmed by system installer based on actual system loads.
5. External, physical dimension shall allow for placement within system enclosure.

B. External Battery Charger:

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt 60 hertz source.
2. Shall be rated for fully charging a completely discharged battery within 60 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.
5. Final battery charger characteristics to be calculated & confirmed by system installer based on actual system loads.

C. Microprocessor based monitoring and control system.

1. The monitoring and control system shall consist of a central processing unit, (CPU), Display Interface Assembly DIA, Remote Annunciator Panels. The system shall be of modular construction, with components connected together using multiplex wiring techniques to provide Fire Detection and Evacuation signals. System shall be Silent Knight IFP-1000 Intelligent, Addressable, and Analog Multiplex Life Alarm or approved equal. CPU shall be surface or flush wall mounted control units where shown. Unit shall have all necessary components to completely supervise and operate the system. Power wiring shall be for single phase operation. Unit shall include the following functional equivalents, as required:
   a. Zone modules.
   b. Power supplies.
   c. Emergency battery for 60 hour backup.
   d. Battery charging circuit.
   e. Auxiliary relays.
   f. Common module.
   g. Controls: System reset, acknowledge, lamp test, trouble, silence.
   h. Indicators: Common alarm, common trouble, AC power failure, low battery, and power on.
   i. Other equipment and components as required for system operation.

2. System shall provide LCD annunciation to indicate system monitor point status, and toggle switches to allow operation of the system control points. Unit shall function as a zone annunciator and control center to initiate alarm or building evacuation function. Control center and Remote Annunciator shall be wall mounted, located as shown, with battery backup, self contained power supply supplied by 120 volt emergency power if available or by dedicated 120 volt normal power circuit.

D. Provide fire alarm system products in sizes and capacities indicated, complying with manufacturer's published product information on standard materials and components designed and constructed for applications indicated.

E. Provide required basic wiring materials as specified in Division 16 sections. Comply with manufacturer's instructions and recommendations.

F. Tamper switches and water flow alarms, when furnished with sprinkler system, shall be connected to Fire Alarm System.

PART 3. - EXECUTION

3.01 INSTALLATION

A. Install system and materials in accordance with manufacturer's instructions and roughing in drawings, and details on the drawings. Install electrical work and use electrical products complying with requirements of applicable Division 16 sections of these specifications.

B. The term "wiring" is defined to include the providing of wire, conduit and miscellaneous materials as required for mounting and connecting the electrical devices. All wiring and devices shall be fully concealed unless otherwise approved by Engineer.

C. Install a complete wiring system as required by the local authority for fire alarm system. Conductor shall be two twisted pair fire alarm cable in a separate conduit system. Provide multi- conductor instrument harness bundle in place of single conductors where a number of conductors can be run along a common path. Fasten flexible conductors bridging cabinets and doors neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. Install a flashing light and horn where indicated on the drawings.

E. Manual stations are to be set 48" above finished floor. Alarm devices are to be set at 80" aff maximum. Alarm devices in Activity rooms, Gymnasiums and other similar use areas shall be suitably protected with substantial wire guards, not less than 11 gauge, and 1" x 2" mesh.

F. Number code or color code conductors, appropriately and permanently for identification and servicing of system.

G. Provide and install new duct detectors in existing air handling equipment. Fire Alarm contractor will need to provide a mechanical contractor for final tie-in and set-up.

3.02 CONNECTIONS

A. The Contractor shall make provisions for and shall connect initiating devices to the Fire Alarm System which may be furnished under other sections of these specifications, whether specifically indicated on the Electrical Series drawings or not. This Contractor shall furnish

wiring, make final connections to auxiliary devices furnished under other sections of the specifications, and provide interface devices such as relays where required:

1. Door Hold Open devices.
2. Fire Door release devices.
3. Duct detectors.
4. Elevator controls.
5. Kitchen hood fire extinguishing equipment.
6. Other dry or wet sprinkler system initiating devices.
7. Dry Contacts for Future Third Party Dialer for outside monitoring.

B. 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.

C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. 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.

D. 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.

3.03 TYPICAL OPERATION:

A. Actuation of any manual station, smoke detector, heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

1. Activate all programmed horn circuits.
2. Actuate strobe units until the panel is reset.
3. Light the associated indicators corresponding to active horn circuits.
4. Release all magnetic door holders, Stage Draft doors and Fire doors to adjacent zones on the floor from which the alarm was initiated.
5. Return all elevators to the primary or alternate floor of egress.
6. A smoke detector in any elevator lobby shall, in addition to the above functions, return all elevators to the primary or alternate floor of egress.
7. Smoke detectors in the elevator machine room or top of hoistway shall return all elevators in to the primary or alternate floor. Smoke detectors or heat detectors installed to shut down elevator power shall do so in accordance with ANSI A17.1 requirements and be coordinated with the electrical contractor.
8. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as appropriate.
9. Activation of any sprinkler system low pressure switch, on valve tamper switch, shall cause a system supervisory alarm indication.

3.04 TEST:

A. 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. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
3. Verify activation of all flow switches.

4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground initiating device circuits and verify response of trouble signals.
8. Ground signaling line circuits and verify response of trouble signals.
9. Ground notification appliance circuits and verify response of trouble signals.
10. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
11. 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.

B. The entire fire alarm system shall be tested in accordance with NFPA standards and other applicable standards. Results of such testing shall be recorded on forms approved for the purpose, certified and submitted to the Owner's representative with final documents.

3.05 FINAL INSPECTION:

A. 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.

3.06 INSTRUCTION:

A. 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.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.07 ZONES

A. Zones shall be identified and scheduled on the Shop Drawing Submittal using current room names and numbers at each campus.

END OF SECTION 283100

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and removing topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and **removing site utilities**.
7. Temporary erosion and sedimentation control.

1.2 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and removal.

C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

D. Burning: No burning is allowed.

1.5 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify **utility locator service** for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control **and plant-protection** measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to detail on drawings.

F. Soil Stripping and Handling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to tree protection detail.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed. Water and sanitary sewer liner shall be capped per requirements of BGJWSC.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Construction Manager and Architect not less than **two (2)** days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

D. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than **2 inches (50 mm)** in diameter, obstructions, and debris to a depth of **36 inches** below exposed subgrade.
3. Chip removed tree branches and **dispose of off-site**.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of **8 inches** (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth **of 6 inches (150 mm)** in a manner to prevent intermingling with underlying subsoil or other waste materials and **dispose of topsoil off site**.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally **dispose** of them off Owner's property.

END OF SECTION 311000

SECTION 312300 – EARTHWORK

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes, but not necessarily limited to, the following:
   1. Excavation as shown or required to attain specified grades.
   2. Surface and subsurface dewatering.
   3. Filling and backfilling as shown and required to attain finished grades shown.
   4. Rough and finished grading of site.
   5. Preparing of subgrade for building foundations, slabs, walks, and pavements.

B. Related work described elsewhere:
   1. Quality Control Services 01 4000
   2. Demolition, Clearing and Grubbing: Section 31 1000.
   3. Trenching; Section 31 2333.

C. Quantity of Soil removal to be included in the contractor’s base bid:

1.02 DEFINITIONS

A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed. Subgrade elevations required:
   1. Completely remove tree stumps and roots.
   2. Completely remove slabs, foundations, pipes and other debris.
   3. Remove 6” of topsoil to a point 10’ outside building foundation walls.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect; unauthorized excavation, as well as remedial work directed by Architect, made at Contractor's expense.
   1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
   2. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.
   3. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

C. Additional Excavation:
   1. When excavation has reached required subgrade elevations, notify Architect, who will make inspection of conditions.

D. Subgrade: Undisturbed earth or compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.03 SUBMITTALS

A. Test Reports: Submit the following reports directly to Architect from the testing services, with copy to Contractor:
   1. Test reports on borrow material.
   2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
   3. Field reports; in-place soil density tests.
   4. One optimum moisture-maximum density curve for each type of soil encountered.
   5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Perform work specified in compliance with applicable requirements of authorities having jurisdiction. Applicable standards include, but are not limited to:
   1. Density of Soil in Place, Sand Cone Method; ASTM D1556.
   2. Moisture Density Relationship of Soil, 5.5# rammer and 12" Drop; ASTM D698.
   3. Density of Soil In-Place, Drive Cylinder Method, ASTM D 2937.

B. All work to be performed in accordance with applicable provisions of the International Building Code, OSHA Safety Requirements, State and Local Ordinances and other authorities having jurisdiction.

C. Testing and Inspection Service: An experienced soil engineer technician, under the direct supervision of an independent geotechnical engineer shall observe all proof rolling, excavation, fill and compaction activities.
   1. Refer to Section 01 4000, Quality Control Services.

D. Testing Laboratory will be selected and paid by the owner.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities in areas of excavation work.
   1. If utilities indicated to remain in place, provide adequate means of support and protection during earthwork operations.
   2. Should uncharted, or incorrectly charted, piping, or other utilities be encountered during excavation, consult utility owner immediately for directions.
   3. Cooperate with Owner and utility companies in keeping respective services and facilities in operation.
   4. Repair damaged utilities to satisfaction of utility owner.
   5. Provide minimum of 48-hour notice to Architect and receive written notice to proceed before interrupting any utility.
   6. Demolish and completely remove from site existing underground utilities indicated to be

removed.

7. Coordinate with utility companies for shutoff of services if lines are active.

B. Protection of Persons and Property:
   1. Excavations to comply with applicable safety regulations. ALL excavations to be shored and/or stepped back in accordance with requirements of OSHA and other regulatory agencies.
   2. Barricade open excavations occurring as part of this work and post with warning lights.
   3. Operate warning lights as recommended by authorities having jurisdiction.
   4. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   5. Perform excavation by hand within dripline of large trees to remain.
      a. Protect root systems from damage or dry out to the greatest extent possible.
      b. Maintain moist condition for root system and cover exposed roots with moistened burlap.

C. Dust Control: Use all means necessary to control dust on and near the work and on or near all off-site borrow areas, if such dust is caused by the Contractor's operation during the performance of the work or resulting from the condition in which the contractor leaves the site.
   1. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public and neighbors.
   2. Dust control measures shall be commenced immediately upon the disturbance of soil and shall continue concurrently with work for duration of construction.
   3. Refer to Section 31 2500; Erosion and Sedimentation Control for additional requirements.

D. Conflicts: Immediately repair or replace structures, facilities, and paving damaged through the performance of work under this contract.
   1. Restore damaged materials to condition existing prior to damage in accordance with best standard practices as approved by Architect.
   2. Restoration and repair to be at no additional cost to the contract.

E. Use of Explosives: Use of explosives not permitted.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory soil materials defined as those complying with ASTM D 2487 soil classification groups GC, GW, GP, GM, SC, SM, SW, and SP.

B. Unsatisfactory soil materials defined as those complying with ASTM D 2487 soil classification groups ML, MH, CL, CH, OL, OH, and PT.

C. Requirements of Suitable and Unsuitable Soils
   1. For the purposes of this contract, the term ‘unsuitable soils’ shall be defined as being **existing** undisturbed soils which are determined by the testing laboratory to be unsuitable for use as structural fill for reasons other than moisture or water content.
   2. Water saturated soils, regardless of whether water is from above or below ground, shall not

be considered as unsuitable. Contractor responsible for dewatering or drying out of water saturated soils to the extent necessary to satisfy the requirements for structural fill.

3. Fill Material: Fill material placed on site from contractor, regardless of whether fill is on-site or off-site borrow.
4. Water Saturated Soils: Should soils become saturated the contractor shall, as part of the scope of this contract, perform activities necessary to mediate and/or replace water saturated soils as required to obtain suitable structural fill as required by the testing laboratory.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

3.02 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   1. All work to be performed in accordance with applicable provisions of the Southern Standard Building Code, OSHA Safety Requirements, State and Local Ordinances and other authorities having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   1. Shore and brace where sloping not possible because of space restrictions or stability of material excavated.
   2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Use of Heavy Equipment
   1. DO NOT use heavy equipment or vibratory equipment adjacent to existing structures or buildings. Contractor shall monitor existing building to ensure no damage is cause by equipment operating near existing structures.

D. Shoring and Bracing:
   1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition.
   2. Maintain shoring and bracing in excavations regardless of time period excavations open.
   3. Extend shoring and bracing as excavation progresses.

3.03 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Soils which are made soft from a lack of dewatering are not considered unsuitable soils. The contractor is responsible for the removal of these soil and replacement with 57 stone under the

direction of the geotechnical engineer at no cost to the owner.

C. Do not allow water to accumulate in excavations. Contractor shall provide measures necessary to dewater the site at no additional cost.
   1. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations.
   2. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
   3. Provide temporary storm drainage systems which may include modifying permanent storm drainage structure for temporary use, under drains and holding ponds.
   4. Provide temporary diversion and ditches consisting of moving both wet and dry soil.

D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas.
   1. Do not use trench excavations or as temporary drainage ditches.
   2. Lower and maintain groundwater level min. of 2'-0" below bottom of excavation and ground surface during preparation and compaction of foundation soils and during placement and compaction of fill and backfill.

3.04 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed.
   1. Place, grade, and shape stockpiles for proper drainage.
   2. Locate and retain soil materials away from edge of excavations.
   3. Do not store within drip line of trees indicated to remain.

B. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill. This disposal of soil is not limited to removal from site to landfill or other location. When material is taken off site material becomes responsibility of the contractor.

3.05 PLACEMENT AND COMPACTION

A. Ground Surface Preparation:
   1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.
   2. Remove grass, roots, and other vegetation completely.

B. Proof rolling:
   1. Proof roll building and pavement subgrades with a heavily loaded tandem axle dump truck by systematically traversing site with overlapping passes.
   2. Areas which pump or rut excessively shall be undercut and backfilled or re-worked in place in accordance with recommendations by the testing laboratory.
   3. Proof rolling shall be performed in the presence of a representative of the geo-technical laboratory.

C. Scarify Sub-grade:
   1. After proof rolling and undercutting, scarify top 6" of subgrade.

2. Plow strip or break up sloped surfaces steeper than 1 vertical to 4 horizontals so that fill material will bond with existing surface.

D. Compact Sub-grade:
   1. Moisture-condition cleared, under cut ground surface to optimum moisture content.
   2. Compact subgrade using a non-vibratory roller, to densities indicated below.

E. Verification:
   1. Upon completion of removal of topsoil, undercutting, proof rolling, scarifying, and compaction activities, geo-technical lab to inspect conditions and verify that subgrade is suitable for installation of building pad and/or structural fill, as applicable.
   2. Laboratory shall be required to verify soil bearing strength at footing bottom and compaction of top 6" sub grade.
   3. DO NOT proceed until sub grade is found, by testing laboratory and Architect, to be suitable.

F. Back fill:
   1. Place backfill and fill materials in layers max. 8" in loose depth for material compacted by heavy compaction equipment, and max. 6" in loose depth for material compacted by hand-operated tampers.
   2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.
   3. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
   4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

G. Placement of Back fill:
   1. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations.
   2. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

H. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below.
   1. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

I. Percentage of Maximum Density Requirements: Compact soil to not less than following percentages of maximum density, in accordance with ASTM D 698:
   1. Under structures, building slabs and steps, structure footings and foundations, and pavements, compact top 12" of subgrade and each layer of backfill or fill material to 95% of standard proctor max. dry density.
   2. Under walkways, curbs and other concrete structures compact top 12" of subgrade and each layer of backfill or fill material to 95% of standard proctor max. dry density.

J. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material.
2. Apply water in min. quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
3. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
4. Stockpile or spread soil material removed because it is too wet to permit compaction.
    a. Assist drying by disking, harrowing, or pulverizing until moisture content reduced to satisfactory value.

3.06 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within tolerance of ±0.10 foot and extending sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

B. Excavations for footings and foundations:
    1. Do not disturb bottom of excavation.
    2. Excavate by hand to final grade just before concrete reinforcement placed.
    3. Trim bottoms to required lines and grades to leave solid base to receive other work.
    4. Do not allow water to accumulate in bottom of footings and foundations.

C. Compaction of Excavated Areas: Upon completion of footing excavation, loosen exposed soil at footing bottom, and compact to 100% of soil's Standard Proctor maximum dry density.
    1. Compaction to take place prior to placing of reinforcing steel.

D. Maintenance of Excavations:
    1. Clean Footing excavations by removing all foreign materials, loose earth, earth clods or stones.
    2. Remove water softened soil and replace with concrete or structural fill. See dewatering requirements.

3.07 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and min. of 6" to 9" of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.
    1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
    2. Do not allow trench excavations to undermine or disturb footings or footing excavations.

C. For pipes or conduit less than 6" nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths.
    1. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

D. For pipes and equipment 6" or larger nominal size, shape bottom of trench to fit bottom of pipe for 90º (bottom 1/4 of circumference).
   1. Fill depressions with tamped sand backfill.
   2. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.08 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature less than 35ºF.

3.09 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

3.10 GRADING

A. General:
   1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
   2. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations indicated, or between such points and existing grades.

B. Grading Outside Building Lines:
   1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
   2. Finish surfaces free from irregular surface changes and as follows:

C. Grading Surface of Fill Under Building Slabs:
   1. Grade smooth and even, free of voids, compacted as specified, and to required elevation.
   2. Provide final grades within tolerance of 1/2" when tested with 10 foot straightedge.

D. Compaction: After grading, compact subgrade surfaces to depth and indicated percentage of maximum or relative density for each area classification.

3.11 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work performed.

B. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.
   1. Field density tests may also be performed by nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556.
   2. In conjunction with each density calibration check, check calibration curves furnished with moisture gages in accordance with ASTM D 3017.
   3. If field tests performed using nuclear methods, make calibration checks of both density and

moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by Architect.

4. Density of Soil In-Place, Drive Cylinder Method, ASTM D 2937.

C. Building Subgrade Area Testing:
   1. Subgrade and Structural Fill:
      a. 1 Test per 3500 S.F. per lift, minimum 5 per lift.
   2. Wall footing Subgrade:
      a. 1 Test per 75 lineal foot of footing; minimum of three.
      b. Perform both Auger and penetrometer tests at each location.
   3. Column Footing Subgrade:
      a. 1 Test for every third footing.
      b. Perform both auger and penetrometer tests.

D. Foundation Wall / Retaining Wall:
   1. Backfill: Perform field density tests 1 Test per 3500 S.F. per lift, minimum 2 per lift.
   2. Wall Footing: 1 Test per 75 lineal foot of footing; minimum of three.

E. If in opinion of Architect, based on testing service reports and inspection, subgrade or fills placed are below specified density, perform additional compaction and testing until specified density obtained.

F. Failure to meet the testing requirements may result in additional testing using alternative testing techniques at no additional cost as directed by Architect.

3.12 MAINTENANCE

A. Protection of Graded Areas:
   1. Protect newly graded areas from traffic and erosion.
   2. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment.
   1. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

3.13 EXCESS SOIL AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

3.14 UNSUITABLE MATERIAL

A. In the event existing areas of soil cannot be compacted to densities described herein, the contractor shall immediately notify the Architect.
   1. Soil classified as unsuitable due to excessive moisture resulting from improper dewatering practices shall be removed and replaced by the contractor at no cost to the contract.

B. If, in the opinion of the Geo-technical laboratory engineer, Civil engineer, and Architect, the soil is unsuitable and cannot be compacted to the specified densities, the soil shall be removed and replaced with satisfactory material on a unit cost basis, through the issuance of a change order.
   1. Unit Costs shall be included on Contractor's Proposal Form, Section "B". Unit cost for removal and replacement of soil shall include all costs necessary to obtain, place and compact soil to required densities, including, but not limited to:
      a. All materials, labor, equipment, taxes, permits, insurance, bonds, overhead and profit.
      b. Removal and disposal of unsuitable materials.
      c. Borrow, placement and compaction of fill.
      d. Additional soil testing required.
      e. Survey cost for verification of quantities.
   2. Quantities of Materials: Material quantities used to determine payment on the unit-cost basis shall be determined through a mathematical calculation of cross sectional area of soil removed.
      a. A separate calculation for replacement materials shall not be performed. It shall be assumed that the replacement material quantity equals the removal quantity.
   3. Quantity of material removed and replaced shall be verified by a Georgia Licensed Surveyor, retained by the contractor.
      a. The cost for the surveyor's services to be included in the unit cost.

C. Soil removal and replacement shall be observed by the Geo Technical Laboratory's and Architect's representatives.

END OF SECTION 312300

SECTION 312333 – TRENCHING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of trenching shown on drawings.

B. System work includes excavation, trenching and backfilling for, but is not limited to, following:
   1. Sanitary sewer system components.
   2. Natural and LP Gas system components.
   3. Storm sewer system components.
   4. Water lines and system components.
   5. Underground electrical lines
   6. Other cables as noted.

C. The contractor's base bid shall include the removal of a certain quantity of soil as defined herein. Should the actual quantity of soil encountered differ from the allowance contained in this section, the contractors contract shall be adjusted, either up or down, based on the a cost obtained by multiplying the actual quantity of soil less the allowance by the unit cost contained in the contractor's bid proposal.

D. Quantity of Soil removal to be included in the contractor's base bid:
   1. Refer to Section 01 2100 - Allowances

E. Related work described elsewhere:
   1. Quality Control Services; 01 4000
   2. Demolition, Clearing and Grubbing: Section 31 1000.
   3. Earthwork; Section 31 2300.

F. Related work required under this section includes:
   1. Cap off or seal discontinued or abandoned utilities; remove portions, which occur within graded or excavated areas.
   2. Dewatering of excavations.
   3. Installation of required erosion control and sedimentation devices.

1.02 QUALITY ASSURANCE

A. All work to be performed in accordance with applicable provisions of the Southern Standard Building Code, OSHA Safety Requirements, State and Local Ordinances and other authorities having jurisdiction.

B. All Construction shall comply with the Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926, subpart P, revised July 1, 1995.

C. If local authorities have standard specifications for pavement removal and replacement, do work in accordance with those specifications.

D. Testing: Initial testing of fill material shall be performed by testing laboratory retained by the contractor. Testing shall comply with provisions of Section, Quality Control.
   1. The contractor shall coordinate required testing with testing laboratory.
   2. Tests required for each 1'-0" of compacted lifts, at no greater than 50'-0" along length of trench.
   3. Do not place succeeding layer of backfill soil until previous layer meets compaction requirements.

1.03 PROTECTION

A. Contractor shall contact the Utilities Protection Inc. “Call Before you Dig” at 1-800-282-7411 prior to beginning any work. Contractor to post dig numbers in Job site trailer.

B. Protect bench marks and existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic; install and maintain proper bridging, planking and cants to provide access to building.

C. Protect excavations by shoring, bracing, underpinning, or by other methods required to prevent cave-ins or loose dirt from falling into excavations.
   1. Methods and procedures utilized shall conform to, as a minimum, the requirements of OSHA and other governing authorities having jurisdiction.

D. Underpin or otherwise support adjacent structure(s), including service lines and pipe chases, to prevent damage by excavation work.

E. Notify Architect of any unexpected sub-surface conditions and discontinue work in area until Architect provides notification to resume work.

PART 2 - PRODUCTS

2.01 BED AND FILL MATERIALS

A. Gravel: Angular (pit run) crushed graded stone shall be angular, ¼” to 1-1/2”; free from shale, clay friable materials and debris. Soil Types GW, and GP.

B. Pea Gravel: Clean natural stone; free from clay, shale and organic matter; 1/4" to 1/2" size.

C. Sand: Clean Natural River or bank sand; free from silt, clay, loam, friable, or soluble materials, and organic matter. Sand shall be course sands and gravels with maximum particle size of 1-1/2” including variously graded sands and gravels. Soil Types SW, and SP.

D. Sub-soil: Free from roots, rock larger than 3" in size and building debris, and approved by testing laboratory for structural fill.

E. Fill under landscaped areas:
   1. Free of alkali, salt, and petroleum products.

2. Use sub-soil excavated from site only if conforming to specified requirements.

F. Portland Cement: ASTM C 150-89.

PART 3 - EXECUTION

3.01 EXCAVATION

A. General:
1. Perform all excavation of every description and of whatever sub-stances encountered, to depths indicated on drawings or as otherwise specified.
2. During excavation, pile material suitable for backfilling in orderly manner sufficient distance from banks of trench to avoid overloading and prevent slides or cave-ins.

B. Remove and waste all excavated materials not required or suitable for backfill.
1. All Unsuitable material must be properly disposed of in a manner acceptable to Architect/ Engineer and to local jurisdiction.
2. All Unsuitable material must be properly disposed in a manner that will not adversely affect the environment.
3. Do such grading as may be necessary to prevent surface water from flowing into trenches or other excavations, and remove any water accumulating therein by pumping or by other approved methods.
4. Do such sheeting and shoring necessary for protection of work and for safety of personnel.

C. Trench Excavation:
1. Provide trenches of min. necessary width for proper laying of pipe.
2. Excavate trenches to depths required in order to lay sewer (sanitary and storm) to the grades and elevations shown on the plans and to lay water lines so that a minimum four (4) feet cover will be achieved over the water line.
3. Unless otherwise indicated on drawings, accurately grade bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length, except for portions of pipe sections where necessary to excavate for bell holes and for proper sealing of pipe joints.
    a. Dig bell holes and depressions for joints after trench bottom graded and only of such length, depth and width required for properly making particular type of joint, so that pipe rests on prepared bottom for nearly its full length as applicable.
    b. Except where rock encountered, take care not to excavate below depths indicated.
    c. Where rock excavation required, excavate to min. overdepth of 8" below trench depth indicated on drawings or specified.
    d. Backfill overdepths in rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly tamped.
4. Where required by the class of embedment to contain a special bedding, take care not to over excavate beyond the trench bottom. Place the required material for the bedding to the required compaction.
5. Where wet or unstable soil incapable of properly supporting pipe, as determined by Architect, encountered in bottom of trench, remove such soil and dewater to depth required and backfill trench to proper grade with a foundation of course sand, fine gravel, or other suitable material,

as hereinafter specified.

D. Sanitary Sewers:
   1. Provide width of trench, at and below 1 foot over top of pipe, such that clear space between barrel of pipe and trench wall is max. 8" on either side of pipe.
   2. Width of trench above that level may be wide as necessary for sheeting and bracing and proper performance of work.
   3. Round bottom of trench so that at least bottom quadrant of pipe rests firmly on bedding material for nearly full length of barrel as proper jointing operations permit.
   4. If bedding is to be specially placed then place bedding material, compact and shape material to receive pipe.
   5. Perform this part of excavation manually, only few feet in advance of pipe laying by men skilled in this type work.

E. Storm Sewers:
   1. Do not make width of trenches for drainage pipe greater than necessary to permit satisfactory jointing and thorough tamping of bedding material around pipe.
   2. Prepare bedding surface to provide firm foundation of uniform density through entire length of culvert or storm sewer.
   3. Carefully shape and round bottom of trench to shape of lowest l/4 of outside circular portion of pipe for its entire length.
   4. If type of pipe requires special bedding and haunching prepare trench in same manner as for sanitary sewer.

F. Water supply, fire and distribution lines:
   1. Except in cases where water lines must be graded, as indicated on plans
   2. Avoid high points with necessity of placing air release and vacuum valves
   3. Provide trenches for water lines of depth to provide min. cover over top of pipe of three (3) feet from existing ground surface or indicated finish grade, whichever lower, and avoid interference of water lines with other utilities.
   4. Provide thrust blocks as indicated or to meet local ordinances and requirements

G. Electrical Ducts or Cables:
   1. Provide trenches for cables or ducts of depth to provide min. 2' of cover over finished grade.
   2. Cut trenches for cables to an overdepth of not less than 3".
   3. Use select backfill material for not less than 3" bedding and 3" backfill over cable.

H. Excavation for Appurtenances:
   1. Make sufficient excavation for manholes and similar structure to leave at least 12" in clear between their outer surfaces and embankment or timber which may be used to hold and protect banks.
   2. Consider any overdepth excavation below such appurtenances that has not been directed by Architect as unauthorized and fill with sand, gravel or concrete as directed, and at expense of Contractor.

I. Excavation Dewatering: Keep trenches dry at all times.
   1. Trenching operations below the water table are considered general earthwork operation. See

Section 02010 Geotechnical Data for approximate elevation of water table.

2. Provide necessary equipment including pumps, piping and temporary drains sufficient to handle both surface and subsurface water.
3. Maintain equipment for duration of trench exposure to elements.

J. Do not discharge drainage water lines into municipal sewers without municipal approval; ensure water discharge does not contain silt held in suspension.

K. Direct surface drainage away from excavated areas.

L. Control grading in and adjacent to excavations to prevent water running into excavated areas or onto adjacent properties or public thoroughfares.

M. Furnish and operate suitable pumps on 24 hour basis to keep excavations free of water until services placed and backfilling completed.

3.02 PIPE BEDDING

A. Bedding Material : Bedding material under and around the pipe shall be placed in six (6)-inch layers and compacted by rodding, spading or with approved vibratory equipment to obtain not less than 98% standard proctor as determined by ASTM Method D698.

3.03 BACKFILLING

A. General: Do not backfill trenches until all required pressure tests are performed and until systems, as installed, conform to requirements specified in the several sections covering installation of various utilities.

B. Backfill materials may consist of the following soil types Class I, Class II, or Class III embedding materials or other approved materials.

C. Contractor shall carefully backfill trenches with approved materials for backfilling. Materials shall be free from large clods of earth or stones and deposited in 6" layers and thoroughly and carefully compact until the following densities are obtained:
1. Areas under structures: 100% standard proctor (ASTM D698).
2. Areas under walks and pavement: 98% standard proctor (ASTM D698).
3. Areas under lawns: 95% standard proctor (ASTM D698) up to the top 12” which shall be compacted to 90% standard proctor (ASTM D698).

D. Take care with specially coated pipe not to damage coating.
1. Place remainder of backfill material in trench in 6" layers and tamp.

E. Settling backfill with water permitted, and a requirement when so directed by Architect.

F. Reopen improperly backfilled trenches, or trenches where settlement occurs, or where tests indicate noncompliance with densities specified, to depth required for proper compaction, then refill and compact, with surface restored to required grade and compaction, mounded over and smoothed off.

G. Backfill open trenches across roadways or other areas to be paved as specified above, except backfill entire trench depth in 6" layers, moisten and compact each layer to density of 98% of standard proctor test, so that paving of area can proceed immediately after backfilling completed.

H. Grade ground to reasonable uniformity along all other portions of trenches and leave mounding over trenches in uniform and neat condition, to satisfaction of Architect.

3.04 TESTING

A. Test for Displacement of Pipe Lines: See Specific Specifications sections for additional testing.
   1. Pipe Lines shall be checked by Architect to determine whether any displacement of pipe occurred, after trench backfilled to 2' above pipe and tamped as specified.
   2. Light flashed between manholes, or, if manholes not yet constructed, between locations of manholes, by means of flashlight or by reflecting sunlight with mirror.
   3. If illuminated interior of pipe lines shows poor alignment, displaced pipe, or any other defects, remedy defects designated by Architect at Contractor's expense.

B. Test for Gradient (slope) of Pipe lines:
   1. Contractor to retain a licensed land surveyor to verify and record gradient (slope) of pipes at 100'-0" intervals and invert elevations at each change in direction and connection with structures.

3.05 PROTECTION OR REMOVAL OF UTILITY LINES

A. General: Protect existing utility lines shown on drawings, or locations of which are made known to Contractor prior to excavation and that are to be retained, or utility lines constructed during excavation operations, from damage during excavation and backfilling; if damaged, repair at Contractor's expense.

B. Existing Utility Lines to be retained: Repair damaged lines that not shown on drawings, or locations of which not known to Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation.
   1. Adjustment in payment made in accordance with General Conditions of Contract.

C. Utility Lines to be removed: Notify Architect in ample time for necessary measures to be taken to prevent interruption of service.

3.06 PAVEMENT REMOVAL AND REPLACEMENT

A. Removal: Where necessary to cut existing pavement, curbs and gutters, walks, drives, other, make cut with neat, parallel straight lines, min. 2' wider than trench width on each side of trench.

B. Replacement:
   1. Replace pavement, curbs and gutters, walks and drives of same cross section as original, except when otherwise detailed on plans, using materials same as original construction.
   2. Backfill open trenches across roadways or other areas to be paved as specified above, except backfill entire trench depth in 6" layers, moisten and compact each layer to density of 100% of

standard proctor test, so that paving of area can proceed immediately after backfilling completed.

C. Temporary Surfaces:
   1. Use temporary road surface of gravel or crushed stone, as approved.
   2. Maintain one-way traffic at all times and street must be fully opened to traffic quickly as possible.
   3. Completely remove temporary materials and dispose of when permanent pavement replaced.

END OF SECTION 312333

SECTION 312500 – EROSION, SEDIMENTATION AND POLLUTION CONTROL PLAN

PART I – GENERAL

1.03 REFERENCED STANDARDS

A. Following requirements made part of these specifications by reference.

1. 2000 edition of "Manual for Erosion and Sediment Control in Georgia" or most recent edition, copies of which available from State Soil and Water Conservation Commission.
2. Standard Details of the Department of Transportation, State of Georgia:
   a. Construction Details for Erosion and Sedimentation Control LE
   b. Temporary Silt Fence and Baled Straw Erosion Control Checks, LE.
   c. Silt Control Gates for Structures, LE
3. "Authorization to Discharge Under the National Pollutant Discharge Elimination System Storm Water Discharges Associated with Construction Activity for Stand Alone Construction Projects", copies of which are available from the Georgia Environmental Protection Division, effective August 1, 2018.

B. Contractor to obtain copy of above specifications and keep available on jobsite at all times during work of this Section.

1. Copies available from Georgia Department of Transportation (404-656-5293), Georgia Environmental Protection Division and from State Soil and Water Conservation Commission.

1.04 QUALITY ASSURANCE:

A. Installer Qualifications:

1. An experienced installer who has completed Erosion, Sedimentation and Pollution Control Plans similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service-performance.
2. The Contractor must disclose to the Architect, prior to project award, of all Georgia Environmental Protection Division, Army Corp of Engineers, and/or City/County/State government agencies' violations received in the last 5 years dealing with erosion and sediment control deficiencies and/or wetlands deficiencies concerning the Contractor and all sub-contractors.
3. Contractor shall have a Qualified Personnel, as defined by Georgia EPD (below), on-site whenever construction activity occurs. After December 31, 2006, a qualified person means a person who has successfully completed the appropriate certification course approved by the state soil and water conservation commission. Contractor shall have at least a level 1A certification.

B. Inspector Qualifications:

1. Contractor shall have a Qualified Personnel, as defined by Georgia EPD (below), on-site whenever construction activity occurs. A qualified person means a person who has successfully completed at least an inspection level 1A certification course and successfully passed the approved examination administered by the state soil and water conservation commission.

C. Pre-installation conference conducted on site to comply with the requirements in Division 1.

1. Inspector Qualifications: Contractor shall have a Qualified Personnel, as defined by Georgia EPD (below), on-site whenever construction activity occurs. According to the *Authorization to Discharge Under the NPDES Storm Water Discharges Associated with Construction Activity General Permit*, "Qualified Personnel" means a person who has successfully completed an erosion and sediment control course eligible for continuing education units, or an equivalent course approved by EPD and the State Soil and Water Conservation Commission"

1.05 PERFORMANCE REQUIREMENTS

A. Erosion control devices required for all earth areas disturbed by grading and or utility system installation operations.

B. Extent of graded areas requiring erosion control indicated on drawings.

C. Types of erosion control activities include, but not limited to:

1. Installation of erosion control devices.
2. Implementation of Best Management Practices (BMPs).
3. Application of temporary ground cover.
4. Maintenance of erosion control devices for duration of contract. Where multiple phase contracts utilized scope of work to include maintenance of erosion control devices installed under previous contracts.
5. Application of permanent ground cover.
6. Removal of erosion control devices.

D. Upon notification of Architect of non-compliance with this specification, contractor has 7 days to address and install additional erosion control devices as directed by the Architect or as may be required.

E. Temporary Erosion Control Measures

1. Contractor shall be responsible for providing addition erosion control as needed to accommodate the construction method to prevent erosion from leaving the site.
2. Contractor is responsible for installation, maintenance and/or repair and/or replacement of all temporary erosion control measures needed to accommodate contractors means and methods which shall include, but not limited to, the following:
   A. Silt fence
   B. Inlet protection

C. Temporary sediment ponds.
D. Down drains/Storm drainage.
E. Construction Exit.

3. Contractor is responsible for all additional costs associated with temporary erosion control measures.
4. Contractor is required to submit additional erosion control measures for approval for sediment ponds and storm drainage for review by the Architect and or review agency.

F. Contractor is responsible for maintenance and/or repair and/or replacement of all erosion control items which shall include, but not limited to, the following:

1. Existing erosion practices already installed under separate contract.
2. Downed silt fence
3. Washed out silt fence and rock
4. Vandalism
5. When silt overburdens structure.
6. Erosion of earth or dam
7. Damage due to abnormal weather conditions.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for erosion control devices, this includes but is not limited to the following:

1. Copy of Certification with GASWCC number of Qualified Person(s)
2. Erosion Control Matting and Blanketing
3. Polyacrylamides
4. Tackifiers and Binders
5. Sediment Barriers
6. Inlet Protection materials
7. Downdrain structures

B. NPDES REQUIREMENTS:

1. Contractor shall submit to Architect in writing within 15 days of receiving the "Notice to Proceed" the name and phone number of the Qualified Person, defined in Section 1.05 paragraph B above, with proof of training (i.e. class certification and/or written verification.)
2. Contractor shall submit a "Notice of Implementation" to the Architect, found in this section, immediately after completing the installation of the initial best management practice devices.

PART II – PRODUCTS

2.01 MATERIALS

A. Refer to plans for required materials and BMPs along with specifications for each.

PART III – EXECUTION

3.01 SEQUENCE OF EVENTS

A. Best Management Practices (BMPs): Shall be implemented during construction activities from the commencement of construction to completion with the initial perimeter control being installed prior to any disturbance.

B. Storm Drainage System: Install as much of permanent storm drainage system as practicable initially and divert surface water into system as directed by the drawings.

1. Install remainder of storm drainage system soon as conditions allow.
2. Maintain temporary sediment barriers around headwall and inlet drainage structures, utilizing silt fence and/or hay bales staked to ground for this purpose.

C. Grading Operations:

1. Schedule grading operations so ground surface disturbed for shortest possible time before permanent construction installed.
2. Immediately place excavated materials into compacted areas.
3. Maintain large areas flat as possible to minimize soil transport through surface flow.

D. Method of Operations.

1. The contractor shall install all additional BMP's that are required as a result of the methods used to construct the site.

3.02 PROTECTION METHODS

A. Best Management Practices (BMPs): At a minimum, best management BMPs should include sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than those practices contained in the "Manual for Erosion and Sedimentation Control in Georgia" published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted, as well as the following:

1. If turbidity producing materials present, hold in sedimentation ponds or grade to erosion control any surface drainage from cuts, fills, topsoil or other material stockpiles within construction limits, whether or not completed, or from borrow or waste disposal areas.
2. Temporary erosion and sediment control measures including, but not limited to berms, dikes, drains, or sedimentation basins required to meet standards; provide and maintain until permanent drainage and erosion control facilities completed and operating.
3. Stripping of vegetation, regrading, and other development activities shall be conducted in such a manner so as to minimize erosion.
4. Cut and fill operations shall be kept to a minimum.

5. Development plans must conform to topography and soil type, so as to create the lowest practicable erosion potential.
6. Whenever feasible, natural vegetation shall be retained, protected, and supplemented.
7. The disturbed area and the duration of exposure to erosive elements shall be kept to a practicable minimum.
8. Disturbed soil shall be stabilized as quickly as practicable.
9. Temporary vegetation or mulching shall be employed to protect exposed critical areas during development.
10. Permanent vegetation and structural erosion control measures shall be installed as soon as practicable.
11. To the extent necessary, sediment in run-off water shall be trapped by the use of debris basins, silt traps, or similar measures until the disturbed area is stabilized.
12. Adequate provisions shall be provided to minimize damage from surface water to the cut face of excavations or the sloping surfaces of fills.
13. Cuts and fills shall not endanger adjoining property.
14. Fills shall not encroach upon natural water courses or constructed channels in a manner so as to adversely affect on other property owners.
15. Grading equipment shall cross flowing streams by the means of bridges or culverts, except when such methods are not feasible, provided in any case that such crossings shall be kept to a minimum.
16. Provisions shall be provided for treatment or control of any source of sediments and adequate sedimentation control facilities to retain sediments on site or preclude sedimentation of adjacent waters beyond the levels specified in this permit.
17. No construction activities shall be constructed within a 25 foot buffer along the banks of all state waters, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, except where the Director of the Georgia EPD (Environmental Protection Division) has determined to allow a variance that is at least as protective of natural resources and the environment, or where a drainage structure or a roadway drainage structure must be constructed, provided that adequate erosion control measures are incorporated in the project plans and specifications and are implemented.
18. No construction activities shall be conducted within a 50 foot buffer, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, along the banks of any state waters classified as “trout streams” except when approval is granted by the Director of the Georgia EPD for alternate buffer requirements, or where roadway drainage structure must be constructed.
19. No construction activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed, state of vegetation until all land-disturbing activities on the construction site are completed. Between the time final stabilization of the site is achieved and upon the submittal of a Notice of Termination, a buffer may be thinned or trimmed of vegetation as long as a protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed.
20. Construct fills and waste areas by selective placement to eliminate silts and clays on surface that erode and contaminate adjacent waterways.

B. **Bf** - Buffer Zone

1. Buffer zones shall be 25’ and maintained on all property lines unless otherwise indicated.
2. Land disturbing activities shall not occur in the buffer zone.
3. If required, trees can be removed from the Buffer Zone using devices that do not disturb the soil. This is to be done only with the approval of the Architect.

3.03 INSTALLATION AND MAINTENANCE

A. **Ds1** – Disturbed Area Stabilization (with mulching only)

1. Install mulch on all building pad areas left for more than seven (7) days.
2. Dry straw or hay shall be applied uniformly at a depth of 2 to 4 inches by hand or by mechanical equipment.
3. Straw or haymulch shall be anchored immediately after application.
   a. Mulch can be pressed into the soil with a disk harrow using packer disk.
   b. Mulch spread with special blower-type equipment may be anchored with emulsified asphalt, takcifers and/or binders.
4. Wood waste shall be applied at a depth of 2 to 3 inches.
5. Cutback asphalt shall be applied at 1200 gallons per acre.
6. Polyethylene film shall be secured over banks or stockpiled soil material for temporary protection.
7. Mulch shall be reapplied whenever ground cover is less than 90%.

B. **Ds2 –** Disturbed Area Stabilization (with temporary seeding)

1. Seed earth areas outside buildings, walks, and paving not to immediately receive permanent grass or landscape with temporary seed producing fast growing cover resistant to erosion.
2. All disturbed earth shall be seeded within 7 days of completion of land disturbing activities or when land disturbing activities are to be discontinued for longer than 2 weeks.
3. Apply hydromulch grass seeding at rate of 2000 pounds per acre on exposed earth areas where slope exceeds 8%.
4. Apply mulch to slopes exceeding one foot vertical in ten feet horizontal (1:10), unless otherwise noted.
5. Conform to temporary grassing and mulching Section 700, 'Standard Specifications, Construction of Roads and Bridges', GDOT, Latest Edition.
6. Maintenance to include watering, refertilization, weeding, mowing, cleaning up and edging and repairs of washouts and gullies.
7. Mow grass to establish turf growth.
8. During establishment of grass, add moisture in upper 4" of soil in intervals and quantities to support continuing grass growth.

C. **Co** – Construction Exit

1. Contractor shall provide construction exits for each location where vehicles leave project site.
2. Contractor shall provide a minimum of one construction exit for each excess to the site.
3. Construction exits shall clean wheels to remove mud before entering public highway or street.

4. Contractor shall provide necessary construction signage when construction exit connects to a public right-of-way.
5. Contractor may be required to replace construction exit once existing is full of silt.
6. Construct construction exit as follows:
    a. Pad thickness of pad: 6" min.
    b. Pad width: Full width of entrance drive, min. 20'-0" at each drive
    c. Pad length: 50'-0" min.
    d. Lining: Geotextile under liner below pad. ASSHTO M-288-98
    e. Stone size: ASTM D448, Size #1, 1-1/2" to 3" diameter max.
    f. Maintain gravel entrance pad for duration of project.
    g. Periodically add 2" top "dressing" to maintain effectiveness of gravel pad.
    h. Sprinkle regularly to settle accumulated silt.

D. **Sd1** – Sediment Barrier: Silt fencing

1. Construct silt fencing in accordance with applicable regulations and details.
2. Contractor shall construct silt fences at toe of embankments or perimeter of all disturbed earth areas, located to interrupt silt transport conveyed by overland surface drainage run off from disturbed areas. Additional silt fence is required as shown on plans
3. Remove, redistribute and compact sediment accumulated behind silt fences immediately prior to beginning temporary grassing.
4. Install proper fabric and post according to specifications in plans.
5. Secure filter fabric to posts using wire ties, cord, wire staples or nails.
    a. Overlap ends of fabric minimum 18”.
    b. Extend bottom of fabric into ground
    c. Trench fabric in a minimum of 12”, Backfill and compact.
6. All earth removed and not needed in construction shall be spread or disposed of so that it will not interfere with the functioning of the silt fence and will not get to waterways.
7. Sediment shall be removed once it has accumulated to one-half the original height of the barrier.
8. Filter fabric shall be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced or when visible tears or imperfections can be seen in the fabric.
9. Contractor shall be prepared to replace the entire quantity of silt fence every six months during the length of construction.

E. **Sd2** – Inlet Sediment Trap:

1. All new and existing inlets shall have inlet protection or sediment traps. Inlet Barriers shall consist of filter fabric, baffle box, or “pigs in a blanket”. Contractor shall install barriers immediately after new structures are in place. Contractor shall install barriers on existing structure prior to any work beginning.
2. Filter Fabric
    a. Type “C” fencing using steel post and wire mesh.
    b. Stakes shall be spaced evenly around the perimeter of the inlet at a minimum of 3 feet apart and driven into the ground approximately 18” deep.
    c. The fabric shall be entrenched 12 inches and backfilled with crushed stone or

compacted soil.

d. Fabric ends must be overlapped a minimum of 18 inches or wrapped together around post to provide a continuous fabric barrier

3. Filter Fabric used during stabilization
   a. When stabilization activities occur filter fabric shall be placed under all grate inlets in between the grate inlet and frame.
   b. This can only be done during construction at the approval of the Architect.
   c. The filter fabric shall be replaced on a monthly basis.
4. Baffle Box
   a. Constructed of 2"x4" boards with maximum of 1" spacing or weep holes 2 inches in diameter.
   b. Gravel shall be placed outside the box to a depth of 4".
   c. Wrap box with type C filter fabric.
5. Curb Filters (pigs-in-a-blanket)
   a. Install after graded aggregate base and or asphalt pavement installation
   b. Wrap 8" concrete block in filter fabric and span across catch basin inlet.
   c. Leave 4" gap between filter and inlet.
6. Polyethylene Structures.
   a. Reusable structures are allowed for new and existing structures.
   b. Structures must have new filter fabric.
   c. Structures must be anchors so they do not move or float.
7. Maintenance:
   a. All traps shall be inspected daily
   b. Sediment shall be removed when the sediment has accumulated to one-half the height of the trap.
   c. Sediment shall be removed from curb inlet immediately
   d. Any sediment which washes into inlet shall be removed immediately at the expense of the contractor.
   e. Sediment removed shall be properly disposed of a minimum of 100 yards away.
   f. Contractor shall be prepared to replace the entire silt fence every six months during the length of construction.

F. **Sd3** – Temporary Sediment Basin & Detention Ponds

1. Fill material:
   a. Shall be approved by a geotechnical engineer for use in a pond.
   b. Must be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material.
   c. Area for fill material shall be scarified prior to placement
   d. Fill material shall be placed in six inch thick continuous lifts.
   e. Compaction shall be 95% proctor
   f. The embankment shall be constructed to an elevation 5% higher than the design height to allow for settlement.
2. Contractor shall install a treated 4 x 4 post indicating the cleanout depth on post.
3. Sediment & Silt shall be removed when one-third of the sediment storage capacity has been lost.
4. Silt shall be removed from and disposed at an approved landfill.

5. When the basin area is to remain after construction, contractor shall:
    a. Clean all drainage devices
    b. Pump the pond dry (must use silt removing devise on the pumping devise)
    c. Remove silt at bottom of pond and grade to elevations.
    d. Grade areas where washing or erosion has occurred
    e. Stabilize areas where washing or erosion has occurred.
    f. Grass any additional areas not stabilized.
6. When the basin area is to be removed after construction, contractor shall:
    a. Remove all drainage devices.
    b. Pump the pond dry (Must use silt removing devise on the pumping devise)
    c. Remove silt at bottom of pond.
    d. Backfill and grade (Refer to Earthwork section for placement of soil)
    e. Stabilize area.

G. **St** – Storm Drain Outlet Protection:

1. Contractor shall provide outlet protection where indicated and required.
2. At each outlet provide outlet protection as follows:
    a. Riprap: Min. 10 Cubic yards Type 3 DOT Rip Rap
    b. Liner: ASSHTO M-288 (type 1)
    c. Minimum thickness of rip-rap should be 1.5 times the maximum stone diameter.
    d. Maintenance: Maintain until grass is established

3.04 CONCRETE WASHOUT AREAS

A. Washout Areas

1. Contractor shall provide Washout areas for each location where concrete vehicles leave project site.
2. Contractor shall provide a minimum of one washout area 10’ x 10’ at the site.
3. Washout areas shall be for disposing of excess concrete, mortar and other similar products.
4. Contractor shall provide sign indicating washout areas.
5. Contractor shall cleanout wash areas as needed during construction.

B. Washout area shall be removed after construction, contractor shall:

1. Pump the pond dry (Must use silt removing devise on the pumping devise)
2. Remove concrete silt at bottom of pond
3. Dispose of material in approved landfill.
4. Backfill and grade (Refer to Earthwork section for placement of soil)
5. Stabilize area.

3.05 PRELIMINARY CLEAN UP

A. Before final inspection, clean paved areas soiled or stained by execution of this work

1. Clean by sweeping or washing and remove defacement or stains.

B. Remove construction equipment, excess materials and tools, and any debris resultant from work.

3.06 REMOVAL OF DEVICES

A. Removal of Temporary Barriers and Silt Controls:

1. Erosion control devices shall remain in location and function until one of the following has occurred:
   a. A permanent device has been installed to replace the function of the temporary device and the permanent device is operational.
   b. The contractor has reached 95% stabilization and submitted a N.O.T.
   c. The N.O.T. has been submitted to the State of Georgia EPD by the Architect.
2. Remove erosion control devices installed under this contract and any erosion devises left from previous phases of work.

3.07 FINAL CLEAN UP

A. Upon removal of erosion control devices and systems Contractor restore site to original condition.

1. Remove construction equipment, excess materials and tools, and any debris resultant from work.
2. Contractor is responsible for removing any erosion practices left from this contract and previous contracts.

3.08 CONDITIONS UPON ACCEPTANCE

A. Following conditions for acceptance apply:

1. No erosion to exist; free site of ruts, crevices or other defects.
2. Silt fences in good condition, vertical, straight, and free of accumulation of silt.
3. Temporary Grass: 80% coverage.
4. Submittal to the Architect of two signed Notice of Terminations (NOTs) found in this Section.

3.09 Schedule: The construction schedule at the end of this document is a preliminary schedule developed by the architect. The development of this schedule does not relieve the operator/contractor from developing a construction schedule. Upon completion of said schedule, the operator/contractor shall replace the architect's schedule in this Section with the developed schedule.

3.10 Forms: All sites greater than 1 acre must complete the forms on the following pages:

NOTICE OF IMPLEMENTATION

PROJECT: _____

CONTRACTOR: _____

DATE: _____ _

This Notice of Implementation is for _____ from
(Project Name)

_____ to John A. Tuten & Associates. Notifying the
(Contractor)

completion of the installation of the initial erosion and sediment control best management devices. These devices have been installed properly and have been inspected by

_____ with _____. The site is ready for
(Name) (Contractor)

inspection by John A. Tuten & Associates. I am aware that any deficiencies reported by John A. Tuten & Associates are to be corrected within seven (7) days of receiving the inspection report.

_____
Contractor

_____
Date Notification
Received by
John A. Tuten & Associates

_____
Name

_____
GASWCC Certification Number

_____
Date

END OF SECTION 312500

SECTION 312510 – COMPREHENSIVE MONITORING PROGRAM

PART I – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings (specifically the soil erosion site plan and accompanying detail sheets); and General Provisions of Contract; Including General; Supplemental General Conditions; and Division 1; apply to work of this Section.

B. Erosion, Sedimentation and Pollution Control Plan in Section 31 2500.

1.02 SUMMARY

A. Work required under this contract: Contractor is not responsible for implementation of this section. Contractor shall participate in all requirements of this section.

B. Work in other contracts: Implementation and management of the Comprehensive Monitoring Program.

C. See Section 312500 for site information.

1.03 REFERENCED STANDARDS

A. Test Procedures established in 40 CFR Part 136.

B. The Guidance document titled "NPDES Storm Water Sampling Guidance Document, EPA 833-B-92-001"

C. "Authorization to Discharge Under the National Pollutant Discharge Elimination System Storm Water Discharges Associated with Construction Activity", copies of which are available from the Georgia Environmental Protection Division, effective August 1, 2008.

1.04 WORK INCLUDED

A. Sampling of storm water discharges at designated outfalls for turbidity in N.T.U. (Nephelometric Turbidity Units). (NOT IN CONTRACT)

B. Daily monitoring of rainfall amounts in the "Daily Rain Gauge Log" found in this document or to be kept in the contractor's daily log.

C. Daily inspection of erosion control devices listed in the "Daily Inspection Log" found in this document or to be kept in the contractor's daily log.

1.05 SAMPLING CONTRACTOR

A. Sampling of storm water outfalls will be conducted by the Owner.

1.06 SUBMITTALS

A. Contractor submit erosion and sediment control plan and narrative to Agency having jurisdiction.
   1. Design plan in accordance with applicable regulations, showing locations and types samples taken. (NOT IN CONTRACT)
   2. Contractor shall submit to the Architect two original signed "Plan Certifications" pages, as found at the end of this document, one week prior to beginning work.
   3. Contractor shall submit a minimum of one (1) Level 1A certifications for personnel to be responsible for the jobsite. Additional certifications can be submitted. ONLY submit contractors that will be working directly on this site.

B. By the 5th of the month the Storm Water Sampling Contractor is required to have the storm water sampling analysis report from the approved lab to the Architect.

1.07 Quality Assurance

A. The Owner is responsible for obtaining a Sampling Contractor.

B. The Contractor is responsible for coordinating construction activities with the Sampling Contractor.

   1. Contractor shall ensure that Construction Activities do not interfere with Sampling Activities. Coordinate any interference with Sampling Contractor.
   2. Contractor shall ensure that Sampling Contractor is notified when Sampling Event occurs.

PART II – PRODUCTS

2.01 MATERIALS

A. Owner shall supply all materials required for storm water sampling.

B. The Contractor shall have a rain gauge on site at all times.

PART III – EXECUTION

3.01 GENERAL

A. Conform all work under this section with the "Manual for Erosion and Sediment Control in Georgia" and the "National Pollutant Discharge Elimination System Storm Water Discharges Associated with Construction Activity" permit.

3.02 NOTICE OF INTENT AND TERMINATION

A. General
   1. The correct forms from the current NPDES permit shall be used.
   2. Sampling Contractor shall submit form in accordance with the permit.

B. Notice of Intent
   1. Contractor cannot begin construction activities until 15 day after Notice of Intent has been filed.
   2. Contractor to provide any information necessary to complete notice of intent forms.

C. Notice of Termination
   1. Contractor shall continue to provide sampling services until Architect and Sampling Contractor has filed Notice of Termination.
   2. Notice of termination cannot be filed until permanent grassing has been successfully established in accordance with the requirements established in Section 2920 Lawns and Grassing.

3.03 NOTICE OF IMPLEMENTATION

A. Notice of Implementation is required prior to beginning any construction activity.

B. Requirements of Notice of Implementation
   1. Contractor shall install erosion control practices in accordance with the initial stage I plan. Until initial erosion measures are installed no other work may occur except those items necessary to install item shown on the Stage I plan.
   2. Once initial practices are installed written notification is required by the contractor to inform the designer that the initial measures are implemented. The designer then has seven (7) working days to inspect the initial controls.
   3. If installation of measures is found acceptable the designer or his representative with sign and date the plans.
   4. A written Notice of Implementation will be produced within three (3) working day of the inspection. Once the indicating the initial measures have been installed according to the drawing.

3.04 EROSION, SEDIMENTATION AND POLLUTION CONTROL PLANS

A. The contractor shall keep a set of the approved plans on the site for erosion inspections only. Changes to the erosion plan shall be marked on this plan only.

B. Only the designer or his representative can make changes to plans. The Contractor, Sampling Contractor, or Owner cannot make revisions to the approved erosion drawings.

C. Contractor and Sampling contractor shall report any recurring issues or suggestions of additional measures to the designer. Only the designer and his representative can make changes to the approved erosion and sedimentation plan.

3.05 SAMPLING (NOT IN CONTRACT)

A. Location: Storm water sampling will occur at outfall locations, and within the proposed project site.

B. Storm water samples will be taken by a grab sample.
   1. The samples should be taken from the horizontal and vertical center of the storm water outfall channel.
   2. Care should be taken to avoid stirring the bottom sediments in the outfall storm water

channel.

3. The sampling container should be held so that the opening faces upstream.
4. The samples should be kept free from floating debris.

C. All samples will be analyzed for turbidity in N.T.U.

D. The Architect reserves the right to request additional sampling parameters when observations made during field inspections merit additional sampling.

3.06 SAMPLE DELIVERY REQUIREMENTS (NOT IN CONTRACT)

A. Samples shall be submitted to an approved lab within 24 hours of collection.

B. The temperature of the sample shall meet the approved labs requirements for submittal.

C. A Chain of Custody, supplied by the lab, shall accompany samples to the lab.

D. The Chain of Custody shall include a written description of any observations of events that occurred during the sampling that may have affected the sampling results in any way.

3.07 REQUIRED STORM WATER SAMPLING EVENTS

A. Sampling shall occur for the following events.
1. For each area of the site that discharges to a receiving stream, the first rain event that reaches or exceeds 0.5 inch and allows for monitoring during normal business hours* (Monday thru Friday, 8:00 AM to 5:00 PM and Saturday 8:00 AM to 5:00 PM**,** excluding all non-working Federal holidays, when construction activity is being conducted by the primary permittee) that occurs after all clearing and grubbing operations have been completed in the drainage area of the location selected as the sampling location;
2. In addition to (1) above, for each area of the site that discharges to a receiving stream, the first rain event that reaches or exceeds 0.5 inch and allows for monitoring during normal business hours* that occurs either 90 days after the first sampling event or after all mass grading operations have been completed in the drainage area of the location selected as the sampling location, whichever comes first;
3. At the time of sampling performed pursuant to (1) and (2) above, if BMPs are found to be properly designed, installed and maintained, no further action is required. If BMPs in any area of the site that discharges to a receiving stream are not properly designed, installed and maintained, corrective action shall be defined and implemented within two (2) business days, and turbidity samples shall be taken from discharges from that area of the site for each subsequent rain event that reaches or exceeds 0.5 inch during normal business hours* until the selected turbidity standard is attained, or until post-storm event inspections determine that BMPs are properly designed, installed and maintained; and
4. Existing construction activities, i.e., those that are occurring on or before the effective date of this permit, that have met the sampling required by (1) above shall sample in accordance with (2). Those existing construction activities that have met the sampling required by (2) above shall not be required to conduct additional sampling other than as required by (3) above.

5. The sampling contractor may choose to meet the requirements of (1) and (2) above by collecting turbidity samples from any rain event that reaches or exceeds 0.5 inch and allows for monitoring at any time of the day or week.

B. **Non-storm water discharges.** Except for flows from fire fighting activities, sources of non-storm water listed in the permit that are combined with storm water discharges associated with construction activity must be identified in the Plan. The Plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

C. Additional samples may be taken once every 6 months a 0.5 inch rainfall during normal business hours shall be sampled as deemed necessary by the sampling contractor.

3.08 SAMPLING REQUIREMENTS

A. The Architect will review all samples on an individual basis.

B. The Contractor must inform the Architect of any activities that occurred during the time of the sampling that may affect the sampling in any manner. This should be placed on or with the Chain of Custody.

3.09 RAINFALL MONITORING (IN CONTRACT)

A. A rain gauge shall be kept on site by the Contractor and monitored on a daily basis.
1. Record rainfall amounts at the beginning of the workday.
2. Record rainfall amounts at the end of the workday.
3. Empty the rain gauge after recording the rainfall amount.

B. The rain gauge log found in this Section shall be used for recording data.

C. The rain gauge logs shall remain on site until completion.

D. The rain gauge logs shall be made available at the request of the Architect or State/County/City/Federal inspector.

3.10 DAILY INSPECTIONS(IN CONTRACT)

A. A daily inspection log is found in this Section shall be used for documenting inspections. A Contractor's daily log book can be used for daily inspections when the Contractor labels the inspection as "Daily Erosion Control Inspection".

B. The daily inspection log shall be used for any of the following inspections:
1. Each day the Operator/Contractor is responsible for site inspection.
2. The contractor shall inspect the site and notify the Architect within 24 hours of the end of a storm that is 0.5 inches when either of the two below conditions occurs.
   a. Disturbed areas of the primary permittee's construction site have not undergone final stabilization.
   b. Areas used for storage materials that are exposed to precipitation have not undergone final stabilization.

3.11 RECORDS RETENTION (IN CONTRACT)

A. Records of all items pertain to storm water monitoring and National Pollutant Discharge Elimination System Storm Water Discharges shall be kept both on project site and at the contractor main or regional offices. These records are to be available at the request of local or state authorities and Architect upon request.

B. Item to be included in records, but not limited to the following:
   1. Land Disturbance Permit
   2. Erosion checklist (if not included in documents)
   3. Copy of Fee Form and checks
   4. Notice of Intent.
   5. Weekly inspections from sampling contractor.
   6. Monthly in sections from sampling contractor.
   7. Rainfall Information (provided by contractor)
   8. Comprehensive monitoring plan (specification section 02370 & 02375)
   9. Notice of Implementation
   10. Letter of Implementation from Architect.
   11. Approved Erosion & Sedimentation Control Plans
   12. Any revisions made to the erosion plans.
   13. Any previous violations.

C. It is the contractor's responsibility to request documents listed above. The Owner, Architect or sampling contractor shall not be responsible for items missing from the records.

3.12 SAMPLING BY CONTRACTOR (IN CONTRACT)

A. Contractor shall be responsible for all costs associated with storm water sampling and NPDES inspections once the project has exceeded the calendar days established in the bid proposal. All change orders shall include costs for sampling.

B. Contractor shall be required to continue sampling services with sampling contractor as previously established by the owner.

3.13 GOVERNMENTAL INSPECTIONS

A. Scheduled Inspections - Contractor shall notify Owner, Architect and Sampling Contractor of any scheduled inspections by the local issuing authority or Georgia Environmental Protection Division.

B. Unscheduled Inspections – Contractor shall notify Owner, Architect and Sampling Contractor immediately after an inspection is made by the local issuing authority or Georgia Environmental Protection Division. Additionally, the contractor shall provide any documentation resulting from the inspection from local issuing authority or Georgia Environmental Protection Division.

PLAN CERTIFICATIONS

Registered Professional Certification: "I certify that the permittee's Comprehensive Monitoring Program provides for the monitoring of the receiving water(s) or the monitoring of the storm water outfalls and is expected to meet the monitoring requirements contained in the General NPDES Permit No.GAR 100000."

Operator/Contractor Certification: "I certify that the receiving water(s) or outfall(s) or a combination of receiving water(s) and outfall(s) will be monitored in accordance with this Comprehensive Monitoring Program."

_____
Signature
(Note: The Architect has the owner signed original document and is available upon request.)

_____
Date

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

RAIN GAUGE LOG
(Sample: Contractor may develop his own as long as information is consistent with this log)

DATE	INSPECTED BY BY:	MORNING		EVENING		SAMPLES TAKEN
		TIME	RAIN (IN.)	TIME	RAIN (IN.)	

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

DAILY INSPECTION LOG

INSPECTOR _____ **DATE** _____

TIME

	Location/Item	Clear of Un-Wanted Debris	Status of Storm Water	Observations	Actions Needed?
Storm Drainage Structures					
	Slope Inspection				

312510-9

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

Location/Item		Clear of Un-Wanted Debris	Status of Storm Water	Observations	Actions Needed?
	Pipe outfall Inspection				
	State Water				
Silt Fence					
	East Side				
	South Side				
	West Side				
	North Side				
	Temporary Grassing				
	Permanent Grassing				
	Material Storage Areas				
	Oil Product Storage Areas				
	Retention Pond				
	Construction Entrance / Exit				

END OF SECTION 312510

312510-10

SECTION 313116 – TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Soil treatment with termiticide.

1.2 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than **five** years against infestation of subterranean termites.

1.3 SUBMITTALS

A. Product Data:

1. Include the EPA-Registered Label for products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranty: Special warranty specified in this Section. **Submit warranty in exact form of final warranty marked "draft, project warranty will be an exact copy and will be promptly issued after application of treatment for the entire project is complete".**

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed in Georgia to apply termite control treatment and products.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from a single manufacturer.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination" to schedule application of termiticide products.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: **Five** years from date of Completion of termite treatment for the project.

1.8 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide **12 months'** continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.
b. Bayer Corporation; Premise 75.
c. Dow AgroSciences LLC; **Dursban TC**.
d. FMC Corporation, Agricultural Products Group; **Torpedo**.
e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for **moisture content of soil,** interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 314000 – SHORING AND UNDERPINNING

PART 1 – GENERAL

1.01 SUMMARY

A. Extent of shoring and underpinning work includes, but not limited to, following:
   1. Shoring and underpinning as necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.
   2. Maintenance of shoring and underpinning.
   3. Removal of shoring and underpinning, as required.

B. Types of shoring and underpinning system includes, but not limited to, following:
   1. Soldier piles.
   2. Lagging.

C. Building excavation is specified in another section.

1.02 SUBMITTALS

A. Layout Drawings:
   1. Provide layout drawings for shoring and underpinning system and other data prepared and sealed by registered Professional Engineer licensed in State of Georgia.
   2. System design and calculations must be acceptable to local authorities having jurisdiction.

1.03 QUALITY ASSURANCE

A. Supervision:
   1. Engage and assign supervision of shoring and underpinning work to qualified foundation consultant.
   2. Submit name of engaged consultant and qualifying technical experience.

B. Regulations: Comply with local codes and ordinances of governing authorities having jurisdiction.

1.04 JOB CONDITIONS

A. Before starting work, check and verify governing dimensions and elevations.
   1. Survey condition of adjoining properties.
   2. Take photographs, to record any prior settlement or cracking of structures, pavements, and other improvements.
   3. Prepare list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, establishing exact elevations at fixed points to act as benchmarks.

1. Clearly identify benchmarks and record existing elevations.
2. Locate datum level used to establish benchmark elevations sufficiently distant not to be affected by movement resulting from excavation operations.

1.05 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction.

C. Comply with requirements of governing authorities and agencies for protection, relocation, removal and discontinuing of services, as affected by Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
1. Provide suitable shoring and underpinning materials to support loads imposed.
2. Materials need not be new, but be in serviceable condition.

B. If wood part of shoring system used near existing structures, use pressure preservative treated materials or remove before placement of backfill.

PART 3 - EXECUTION

3.01 SHORING

A. Whenever shoring required, locate system to clear permanent construction and permit forming and finishing of concrete surfaces.
1. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Leave shoring systems retaining earth on which support or stability of existing structures dependent in place at completion of work.

3.02 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work.
1. If necessary to move brace, install new bracing prior to removal of original brace.
2. Do not place bracing where cast into or included in permanent concrete work, except as otherwise acceptable to Architect.

B. Install internal bracing, if required, to prevent spreading or distortion to braced frames.

C. Maintain bracing until structural elements rebraced by other bracing or until permanent floor construction able to withstand lateral earth and hydrostatic pressures.

D. Remove sheeting, shoring and bracing in stages to avoid disturbance to underlying soils and damage

to structures, pavements, facilities, and utilities.

E. Repair or replace, as acceptable by Architect, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION 314000

SECTION 321300 – WALK, ROAD AND PARKING APPURTENANCES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of walkway, roadway and parking appurtenances shown on drawings.

B. Types of walkway, roadway and parking appurtenances include:
   1. Traffic and directional signage.
   2. Pipe Bollards.
   3. Sleeves

B. Related Work Specified Elsewhere:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this Section.
   2. Playing Courts and equipment specified in other Division-2 sections.
   3. Traffic Painting specified in other Division-2 sections.
   4. Site lighting specified in Division-16 sections.

1.02 QUALITY CRITERIA

A. Industry Standards: Industry standards as follows applies to work except as noted herein or otherwise indicated on drawings
   1. Contractor keep current copy of Standard Specifications on file at site.
   2. Conform to requirements of Department of Transportation, State of Georgia "Standard Specifications, Construction of Roads and Bridges", 1993 edition, hereinafter noted as "Standard Specifications" except for modifications or additions as specified herein.
      a. Where terms in Standard Specifications used, intent understood as follows:
         (1) "State" = Owner.
         (2) "Department" = Architect and/or Owner's representative.
         (3) "Engineer" = Owner's representative.
         (4) “Proposal Form" = Proposal, General or Special Conditions or Technical Specifications.
   3. Modify Standard Specifications by deletion references to method of measurement and basis for payment in Section 109.
   4. Comply with local governing regulations if more stringent than herein specified.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's or fabricator's specifications and installation instructions for products specified in this section, including finishes, anchorage requirements and setting diagrams.

B. Shop Drawings: Submit shop drawings for each fabricated or manufacturer item specified in this section, showing types, sizes, location, construction, finish, anchorage, and other pertinent information.

C. Samples: Submit two representative sample of each finish required for factory finished products if

specified or requested by Architect.

PART 2 - PRODUCTS

2.01 TRAFFIC AND DIRECTIONAL SIGNAGE

A Provide signs of type, size, location and text shown on drawings and specified in this Section.
1. Signs shall be aluminum
2. Minimum Size
   a. Regulatory Signs 24” x 24”
   b. Handicap and parking 12” x 18”
3. Minimum Gauge of material 0.080
4. Signs shall have Protective Coating against dirt and graffiti
5. Paint shall be reflectorized for high visibility
6. Use only aluminum fasteners galvanized steel supports
7. Posts
   a. Galvanized with green coating
   b. Weight #3 lbs. per ft.

A. Provide international shapes and symbols unless otherwise indicated.

B. Comply with Georgia DOT Standard Specifications and Manual Uniform Traffic Control Devices as applicable for type, style, and sign installation.

2.02 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 80 steel pipe.
   i. Cap bollards with 1/4" min. thickness steel plate.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4" thick steel plate welded to bottom of sleeve.

2.03 SLEEVES (For Future Use)

A. Sleeves : All sleeves shall be 6” in diameter.

B. Provide number of sleeves on plans. If sleeves are not indicated provide sleeves to all islands and under all roadway and sidewalks every 500’ minimum. All roadways and sidewalks shall have at least one sleeve.

C. Sleeves shall be SDR33, C900 or Schedule 40 PVC piping. All fittings shall match pipe materials.

D. Pipes shall be placed at a minimum depth of 3’-0” below walks and 5’-0” below roadway.

E. Pipes shall be width of roadway or sidewalk plus 10’ on each side.

F. All sleeves shall be turned 90 degrees toward surface. At surface piping shall extent above ground a minimum of 2’-0”.

G. Joints shall not be glued.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchor each item securely as shown on drawings or, as recommended by manufacturer if not shown.

B. Set members straight, true and plumb.

C. Where anchorage in concrete, brace well until concrete set.

3.02 INSTALLATION OF BOLLARDS

A. Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete.
   1. After bollards inserted into sleeves, fill annular space between bollard and sleeve solid with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

3.03 INSTALLATION OF TRAFFIC AND DIRECTIONAL SIGNAGE

A. Posts shall be installed with a 3:1 cement sand mix.

B. Posts shall be placed as close to vertical as possible.

C. Sign Location
   1. On road side 5’ edge of pavement
   2. At parking stalls 3’ behind parking space or behind sidewalk if applicable
   3. Other areas per location on plans.

D. Height of signs
   1. Handicap - 7’ from bottom of sign to ground surface
   2. Regulatory and parking – 5’ from bottom of sign to ground

3.04 ADJUST AND CLEAN

A. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of shop paint on ferrous metal specified in Division 9 sections.

B. Galvanized surfaces: Clean field welds, bolted connections and abraded areas, apply 2 coats of galvanizing repair paint.

C. Restore wood finishes damaged during shipment or installation of work.

D. Protect from damage during course of construction and repair or replace if damage occurs, at no additional cost to Owner.

E. Provide protective coverings, retain intact and remove simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

END OF SECTION 321300

SECTION 321613 – SIDEWALKS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Extent of concrete walks shown on drawings.

1.02 RELATED WORK

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

B. Earthwork and prepared subbase is specified in sections 31 2300.

C. Concrete and related materials as specified sections.

D. Joint Fillers and Sealers are specified sections.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.04 SUBMITTALS

A. Submit samples, manufacturer's product data, test reports and material certification as required in referenced sections of concrete work and joint fillers and sealers.

1.05 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
   1. Provide flagmen, barricades, warning signs and warning lights for movement of traffic and cause least interruption of work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
   1. Use flexible spring steel forms or laminated boards to form radius bends as required.
   2. Coat forms with non-staining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded cold-drawn steel wire fabric complying with ASTM A 185.

C. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

D. Expansion Joint Materials: Comply with requirements of Division-7 sections for preformed expansion joint fillers and sealers.

2.02 TRUNCATED DOMES (HANDICAP RAMP)

A. See Specification section 02780 Unit Pavers
B. Comply with requirements for Precast Truncated Domes Meeting ADA Specifications
C. Domes shall be precast brick or paver. Maximum size shall by 18” x 18”
D. Architect shall determine color. Contractor to provide option of all standard colors including by not limited to Brown, Red, Yellow and Gray.

2.03 CONCRETE MIX, DESIGN AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.
   1. Design mix to produce standard-weight concrete consisting of portland cement, aggregate, air-entraining admixture and water to produce following properties:
      a. Compressive Strength: 3000 psi, minimum at 28 days.
      b. Slump Range: 2" to 4".
      c. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which concrete curbs, walks, and paving to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work.
   1. Do not proceed with work until unsatisfactory conditions corrected in acceptable manner.

3.02 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.
   1. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction.
   2. Do not begin paving work until such conditions corrected and ready to receive paving.

B. Compact sub-base at areas to receive concrete paving and 10'-0" beyond limits of paving as described herein.

C. Compact sub-base to 95% of Standard Proctor Maximum Dry Density (ASTM D698) to a minimum depth of 3'-0".

1. Compaction shall be accomplished through use of vibratory compaction equipment.
2. Moisten soil as required to obtained specified densities.

D. Compact surface to 98% of Standard Proctor Maximum Dry Density (ASTM D698).
1. Compaction shall be accomplished through use of static rolling equipment.
2. Moisten soil as required to obtained specified densities.

3.03 CONCRETE PADS

A. Place concrete pads at each exterior door where no side walk exists. Pad to be min. 5'-0" deep by the width of the door opening plus 2'-0".

B. Construct concrete equipment pad for each exterior item of equipment, including, but not limited to, HVAC equipment, electrical equipment, transformers, generator, cooler/freezer compressors.
1. Individual equipment pads to be of 6" larger than equipment each direction unless larger pad detailed.
2. Multiple pads adjacent to each other construct a single pad of sufficient size to handle all equipment complying with the following:
a. Equipment to have a min. of 3'-0" between items of equipment.
b. Equipment shall be a min. of 3'-0" from face of structure.
c. Provide a min. of 1'-0" from face of equipment to face of concrete slab.

C. Pad(s) to slope away from the building at 1/8" per foot to drain water.

3.04 CONCRETE SIDEWALKS

A. General:
1. Minimum Thickness of sidewalks shall be 4 inches.
2. Edge of Concrete shall be thickened to 5 inches minimum.
3. Finished sidewalk appearance shall be approved by architect.
a. Cracking, breaks in concrete, pits in concrete surface, and rough finish are not acceptable.

B. Place sidewalks where indicated in drawings.
1. Width of walks to be as shown. If not shown minimum of 5'-0".
2. Longitudinal slope on side walks shall be no more 1:20; unless specifically noted otherwise.
3. Transverse slope shall be 1/8" per foot to drain water away from building; unless noted otherwise.
4. Finished grade on up hill side of walk to be flush with top of walk.

3.05 HANDICAPPED CURB CUTS

A. Provide handicapped curb cuts where indicated on drawings or required herein.

B. Handicapped curb cuts to be constructed in the following locations:
1. Where a perpendicular sidewalk abuts a concrete turn down or concrete curb and gutter at asphalt or concrete pavement.

2. Main entrance to building.
3. Bus loading entrance to building.
4. Handicapped parking spaces
5. Walk to flag pole.

C. Construct handicapped curb cuts in accordance with the applicable details and as follows:
1. In accordance with requirements of agencies having jurisdiction.
2. Width: Min. 5'-0".
3. Depth: 6'-0" for a 6" curb.
4. Slope of ramp and flared edges: Max. 1:12.
5. Tactile Warning Surface: Truncated Domes

D. Sample: Prior to constructing handicapped curb cuts or ramps the contractor shall construct a sample curb cut utilizing materials and methods specified for review and approval by the Architect and Agency having jurisdiction.
1. Approved samples may be incorporated into the work.
2. Rejected samples to be removed and reconstructed as directed.

3.06 FORM CONSTRUCTION

A. Set forms to required grades and lines, rigidly braced and secured.
1. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
2. Check completed formwork for grade and alignment to following tolerances:
a. Top of forms not more than 1/8" in 10'.
b. Vertical face on longitudinal axis, not more than 1/4" in 10'.

B. Clean forms after each use and coat with form release agent often as required to ensure separation from concrete without damage.

3.07 CONCRETE PLACEMENT

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.

B. Preparation:
1. Do not place concrete until subbase and forms checked for line and grade.
2. Moisten subbase if required to provide uniform dampened condition at time concrete placed.
3. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Placement:
1. Place concrete using methods, which prevent segregation of mix.
2. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator.
3. Keep vibrator away from joint assemblies, reinforcement or side forms.

4. Use only square-faced shovels for hand-spreading and consolidation.
5. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.

3.08 JOINTS

A. General:
   1. Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete, unless otherwise indicated.
   2. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Perimeter Joints:
   1. When walkway abuts existing walks, place transverse joints to align with previously paved joints unless otherwise detailed.

C. Weakened-Plane (Contraction) Joints:
   1. Provide weakened-plane (contraction) joints, sectioning concrete into areas indicated. If not indicated place weakened-plane joints at a maximum spacing of 5'-0" each direction.
   2. Construct weakened-plane joints for depth equal to at least 1/4 concrete thickness, as follows:
   3. Joints to be true and straight, either parallel or perpendicular to side of walk.
   4. Unless otherwise approved in writing by the Architect weakened-plane joints to be tooled type joints. Sawed cut joints of any type are **NOT** acceptable.
      a. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion of slab with recommended cutting tool and finishing edges with jointer.
      b. Sawed Joints: **NOT** accepted.
      c. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove after concrete has hardened.

D. Construction Joints:
   1. Place construction joints at end of all pours and at locations where placement operations stopped for period of more than 1/2-hour, except where such pours terminate at expansion joints.
   2. Construct joints as shown or, if not shown, use standard metal key-way section forms.

E. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
   1. Locate expansion joints at 30' o.c. for each pavement lane, unless otherwise indicated.

   2. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than l" below finished surface where joint sealer indicated.
   3. If no joint sealer required, place top of joint filler flush with finished concrete surface.

3.09 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating.
   1. Use hand methods only where mechanical floating not possible.

2. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with 10' straightedge.
   1. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

C. After completion of floating and when excess moisture or surface sheen disappears, complete surface finishing, as follows:
   1. Burlap finish, by dragging seamless strip of damp burlap across concrete, perpendicular to line of traffic; repeat operation to provide gritty texture acceptable to Architect.
   2. Light Broom finish, using a stiff bristle brush place a light broom finish. Deep grooves in sidewalk finish are not permitted. If direction of brush pull is evident, sidewalk will be rejected.

3.10 EXPOSED GRAVEL SURFACE

A. Prior to constructing exposed gravel surface the contractor shall construct a sample curb cut utilizing materials and methods specified for review and approval by the Architect.
   1. Approved samples may be incorporated into the work.
B. Rejected samples to be removed and reconstructed as directed.
C. Exposed gravel to completely fill areas designated.
D. Joints are to be placed prior to placing gravel. Sawed Joints are **NOT** accepted.

3.11 FORM REMOVAL

A. Do not remove forms for 24 hours after concrete placed.
   1. After form removal, clean ends of joints and point-up any minor honeycombed areas.
   2. Remove and replace areas or sections with major defects, as directed by Architect.

3.12 CURING

A. Protect and cure finished concrete paving, complying with applicable requirements of Division 3 sections.
   1. Use moist-curing methods for initial curing whenever possible.

3.13 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete, as directed by Architect.

B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas.
   1. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy resin grout.

C. Protect concrete from damage until acceptance of work.
   1. Exclude traffic from pavement for at least 14 days after placement.
   2. When construction traffic permitted, maintain pavement as clean as possible by removing

surface stains and spillage of materials as they occur.

D. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION 321613

SECTION 323113 – VINYL COATED CHAIN LINK FENCING AND GATES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of chain link fences and gates indicated on drawings and herein.

1.02 QUALITY ASSURANCE

A. Provide chain link fences and gates as complete units controlled by single source including necessary erection accessories, fittings, and fastenings.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

PART 2 – PRODUCTS

2.01 GENERAL

A. Fence and Gates to be of sizes indicated on drawings; if not indicated the following shall apply:

B. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

C. Manufacturer: Subject to compliance with requirements, provide products of one of following:
   1. Galvanized Steel Fencing and Fabric:
      a. Allied Tube and Conduit Corp.
      b. American Fence Corp.
      c. Anchor Fence, Inc.
      d. Page Fence Div./Page-Wilson Corp.
      e. Cyclone Fence/United States Steel Corp.

2.02 STEEL FABRIC

A. Fabric:
   1. No. 9 ga. (0.148" $\pm$ 0.005") finished size steel wires.
   2. 1-3/4" mesh at tennis courts; 2" mesh elsewhere.
   3. Top selvages knuckled for fabric 60" high and under, both top and bottom selvages twisted and barbed for fabric over 60" high.
   4. Furnish one-piece fabric widths for fencing up to 12' high.

B. Fabric Finish: Galvanized, ASTM A 392, Class I, with min. 1.2 oz. zinc per sq. ft. of surface with

extruded Polyvinyl Chloride coating (PVC).

C. Color shall be selected by Architect.

2.03 FRAMING AND ACCESSORIES

A. General:
1. All Framework and Accessories shall be galvanized and extruded Polyvinyl Chloride coating (PVC).

B. Steel Framework:
1. General: Galvanized steel, ASTM A 120 or A 123, with min. 1.8 oz. zinc/s.f. of surface.
2. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

C. End, Corner and Pull Posts: Min. sizes and weights as follows:
1. Up to 6' fabric height: 2.375" OD steel pipe, 3.65 lbs./l.f., or 3.5" x 3.5" roll-formed sections, 4.85 lbs./l.f.
2. Over 6' fabric height: 2.875" OD steel pipe, 5.79 lbs./l.f., or 3.5" x 3.5" roll-formed sections, 4.85 lbs./l.f.

D. Line Posts: Space 10' o.c. max., unless otherwise indicated, of following min. sizes and weights.
1. Up to 6' fabric height: 1.90" OD steel pipe, 2.70 lbs./l.f. or 1.875" x 1.625" C-sections, 2.28 lbs./l.f.
2. 6' to 8' fabric height: 2.375" OD steel pipe, 3.65 lbs./l.f. or 2.25" x 1.875" H-sections, 2.64 lbs./l.f.
3. Over 8' fabric height: 2.875" OD steel pipe, 5.79 lbs./l.f. or 2.25" x 1.875" H-sections, 3.26 lbs./l.f.

E. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of double gate installation, for nominal gate leaf widths as follows:
1. Up to 6': 3.5" x 3.5" roll-formed section, 4.85 lbs./l.f. or 2.875" OD pipe, 5.79 lbs./l.f.
2. Over 6' to 13': 4.000" OD pipe, 9.11 lbs./l.f.
3. Over 13' to 18': 6.625" OD pipe, 18.97 lbs./l.f.
4. Over 18': 8.625" OD pipe, 28.55 lbs./l.f.

F. Top Rail:
1. Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint.
2. Provide means for attaching top rail securely to each gate, corner, pull and end post.
3. 1.66" OD pipe, 2.27 lbs./l.f. or 1.625" x 1.25" roll-formed sections, 1.35 lbs./l.f.

G. Tension Wire: 7 gage, coated coil spring wire, metal and finish to match fabric.
1. Locate at bottom of fabric only.

H. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.

I. Post Brace Assembly:
1. Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner

and pull posts, with horizontal brace located at mid-height of fabric.

2. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightened.

J. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

K. Stretcher Bars:
   1. One-piece lengths equal to full height of fabric, with min. cross section of 3/16" x 3/4".
   2. Provide one stretcher bar for each gate and end post, 2 for each corner and pull post, except where fabric integrally woven into post.

2.04 GATES

A. Fabrication:
   1. Fabricate perimeter frames of gates from metal and finish to match fence framework.
   2. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections.
   3. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories.
   4. Space frame members max. 8' apart unless otherwise indicated.
   5. Provide same fabric as for fence, unless otherwise indicated.
      a. Install fabric with stretcher bars at vertical edges and at top and bottom edges.
      b. Attach stretcher bars to gate frame max. 15" o.c.
      c. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.

C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with following:
   1. Hinges:
      a. Size and material to suit gate size, non-lift-off type, offset to permit 180^{o} gate opening.
      b. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
   2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

D. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

2.05 PADLOCKS

A. Provide One each Pad Lock for each gate; pad locks to be keyed alike.

2.06 CONCRETE

A. Provide concrete consisting of portland cement, ASTM C 150, aggregates, ASTM C 33, and clean water.

B. Mix materials to obtain concrete with min. 28-day compressive strength of 2500 psi using min. 4 sacks of cement per cu. yd., 1" max. size aggregate, max. 3" slump, and 2% to 4% entrained air.

PART 3 – EXECUTION

3.01 GENERAL

A. Unless detailed or noted otherwise the size of the fence shall be as required to provide a minimum of 3'-0" clearance on all sides of equipment being enclosed.

B. Line Posts: Space posts equidistant at intervals not exceeding ten (10) feet on center.

C. Terminal and Pull Posts: Set Terminal or Pull Posts (End, Corner and Gate) at the beginning and end of each continuous length of fence and at abrupt changes in vertical and horizontal alignment.
   1. Maximum spacing for terminal or pull posts 10 be 1,000 feet.

3.02 INSTALLATION

A. Do not begin installation and erection before final grading completed, unless otherwise permitted.

B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
   1. If not indicated on drawings, excavate holes for each post to min. diameter recommended by fence manufacturer, but min. 4 times largest cross-section of post.
   2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
   1. Place concrete around posts and vibrate or tamp for consolidation.
   2. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
   3. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to crown to shed water.

D. Top Rails:
   1. Furnish top rails for all fences.
   2. Run rail continuously through post caps, bending to radius for curved runs.
   3. Securely fasten the top rail to terminal posts and join with sleeves or couplings which allow for expansion and contraction.

E. Tension Wire:
   1. Furnish bottom tension wire at al fences.
   2. Install bottom tension wire within bottom 4" of fence fabric.
   3. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings 24" o.c.
   4. Securely fasten tension wire to terminal and line posts.
   5. Tension wire shall be taut and free of sag.

F. Brace Assemblies:
   1. Install braces to plumb posts when diagonal rod under proper tension.

G. Fabric:
   1. Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated.
   2. Pull fabric taut and tie to posts, rails, and tension wires.
   3. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force released.
   4. Place fabric by securing one end, applying sufficient tension to remove slack prior to making attachments. Tighten fabric to provide a smooth uniform appearance free from sag.
   5. Join rolls of wire fabric by weaving a single picket into the ends of the rolls to form a continuous mesh. Then retwist or reknuckle the pickets back to provide a uniform appearance.

H. Stretcher Bars: Thread through or clamp to fabric 4" o.c., secure to posts with metal bands 15" o.c.

I. Gates:
   1. Install gates plumb, level, and secure for full opening without interference.
   2. Install gates to provide min. of 2" and a maximum of 4" clearance between bottom of gate and grade at any point along direction of travel.
   3. Install ground-set items in concrete for anchorage.
   4. Adjust hardware for smooth operation and lubricate where necessary.

J. Tie Wires:
   1. Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted min. 2 full turns.
   2. Bend ends of wire to minimize hazard to persons or clothing.
   3. Tie fabric to line posts, with wire ties 12" o.c.
   4. Tie fabric to rails and braces, with wire ties 24" o.c.
   5. Tie fabric to tension wires, with hog rings 24" o.c.

K. Fasteners:
   1. Install nuts for tension bands and hardware bolts on side of fence opposite fabric side.
   2. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 323113

SECTION 323121 – ALUMINUM LOUVER FENCING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: Ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts and aluminum louver gates.

B. Related sections:

1. Section 033000 Cast-in-Place Concrete: Concrete footings for support of fence posts.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

2. ASTM B221 – Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

3. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.

4. ASTM D822 – Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.

5. ASTM D2794 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

6. ASTM D3363 – Test Method for Film Hardness by Pencil Test.

1.3 SUBMITTALS

A. Provide in accordance with Section 013300 Submittal Procedures:

1. Product data for components and accessories.

2. Shop drawings showing layout, dimensions, spacing of components, and anchorage and installation details.

3. Sample: [8 by 10 inches] [203 by 254 mm] minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.

4. Copy of warranty specified in Paragraph 1.4 for review by Architect.

1.4 WARRANTY

A. Provide in accordance with Section 017700 Closeout Procedures:

1. 10 years warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360 and Ultra Fencing Railing, www.ultrarailing.com , (800) 656-4420.

B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Product Substitution Procedures.

2.2 MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

2.3 FENCE SYSTEM

Phoenix: Extruded tubular aluminum blades provideed with 100 percent visual blocking.

A. Type: Ornamental fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts; Phoenix Aluminum Fixed Louver Fencing as manufactured by Ametco Manufacturing Corporation.

B. Fence panel:

1. Fixed louver blades: Extruded tubular aluminum louver blades, inclined at 45 degrees, and [spaced at [2.83 inches] [72 mm] and to provide 100 percent direct visual screening.] [spaced at [3.4 inches] [86 mm] to provide 80 percent direct visual screening.]

a. Size: [1/2 by 4 inches] [13 by 102 mm].

b. Material thickness: [0.09 inch] [2 mm].

2. Framing bars: Extruded aluminum flat bars welded to ends of louvers.

3. Panel sizes shown on drawings.

C. Posts:

1. Type: 4 by 4 inches extruded tubular aluminum sections with solid aluminum caps.

2. Length: As indicated on Drawings.

2.4 GATES

A. Provide gates of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.

B. Type: Hinged swinging one single and one pair of double gate.

1. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material.

2. Nominal size: Gate sizes shown on drawings.

3. Hardware:

a. Hinges: Size and type as determined by manufacturer. Provide 3 hinges per leaf.

b. Latch: 3/4 inch [19 mm] diameter slide bolt to accommodate padlock.

c. For double gates provide padlockable, 5/8 inch [16 mm] diameter center cane bolt assembly and strike.

2.5 ACCESSORIES

A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

2.6 FACTORY FINISH

A. Aluminum fence panels and posts shall receive polyester powder coating or with 2-part polyurethane coating.

B. Polyester Powder Coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

4. Minimum hardness measured in accordance with ASTM D3363: 2H.

5. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.

6. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than [3/16 inch] [5 mm] undercutting.

7. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45

degrees.

C. Polyurethane Coating: 1.0 mil dry film thickness of coating of test panel cured 30 minutes at 180-degree F and aged 14 days shall resist the following test conditions without failure:

1. 5 percent salt spray for 500 hours.

2. 100 percent relative humidity for 1000 hours.

3. Water immersion for 100 hours.

4. 20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.

5. Exposure to lubricating oils, hydraulic fluids, and cutting oils.

6. 16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 degrees F, and 24 hours at 77 degrees F.

7. Hardness: H to 2H.

8. Flexibility: 1/8 inch conical mandrel.

D. Color: Selected by Architect from manufacturer’s standard range.

PART 3 – EXECUTION

3.1 PREPARATION

A. Prior to fabrication, field verify required dimensions.

B. Cast concrete footings in accordance with Section 03 30 00 - Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.

1. Minimum footing diameter:

a. Terminal and gate posts: 16 inches.

b. Intermediate line posts: 12 inches.

2. Allow 8 inches (203 mm) minimum embedment of posts.

3. Allow 6 inches (152 mm) minimum concrete beneath post bottom.

3.2 INSTALLATION

A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.

B. Install fence posts plumb and level by setting post in hole cast in concrete and grouting solid. Temporarily brace fence posts with 2 by 4 wood supports until [concrete] [grout] is set.

C. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

D. Secure fence panels with standard stainless-steel bolts to fence posts.

E. Gates:

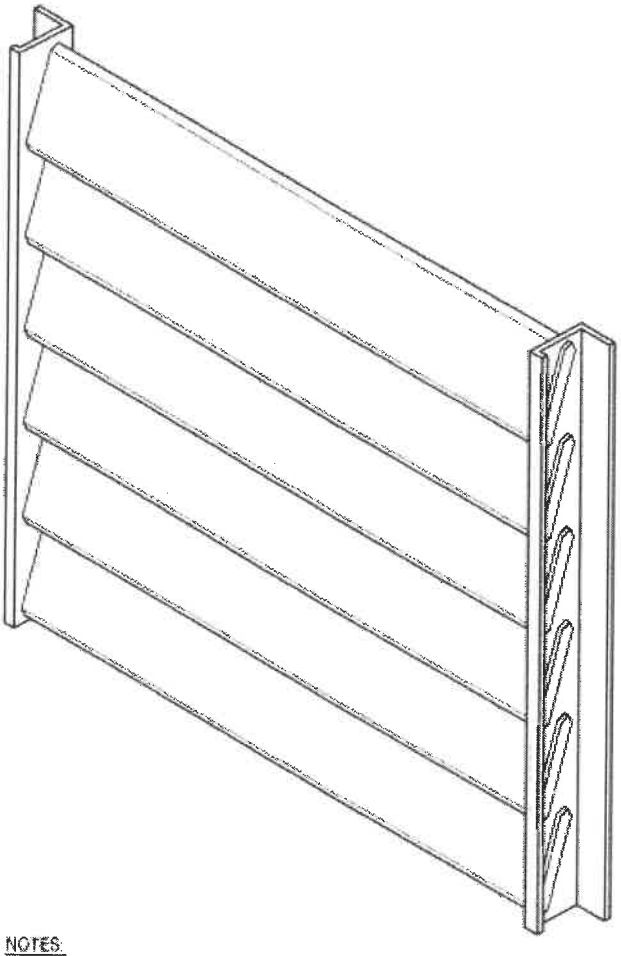
4. Install gates and adjust hardware for smooth operation.

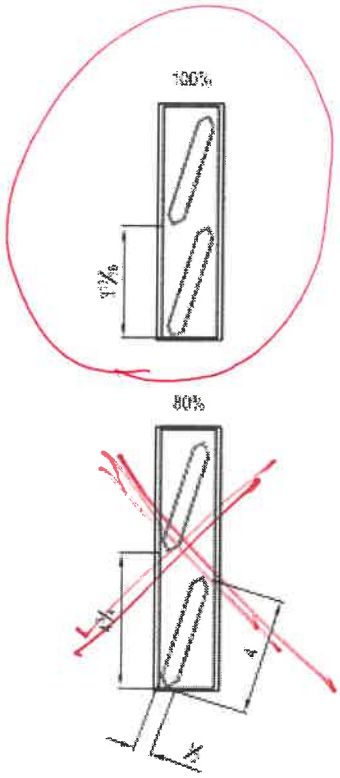
5. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.

F. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 323121

AMETCO MANUFACTURING CORPORATION
4326 HAMANN PARKWAY P.O. BOX 1210
WILLOUGHBY, OHIO 44096
TOLL FREE: 1-800-321-7042
PHONE: (440) 951-4300
FAX: (440) 951-2542
www.ametco.com





NOTES:

1. IT IS RECOMMEND THAT THE PHOENIX DES GN BE USED HOR ZONTALLY.
2. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3. ALL DIMENSIONS ARE CONSIDERED TRUE AND REFLECT MANUFACTURER'S SPECIFICATIONS
4. AMETCO'S ALUM NUM FENCING SYSTEM IS 100 % MANUFACTURED N THE UNITED STATES.
5. DO NOT SCALE DRAWINGS
6. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info REFERENCE NUMBER 048-090

ALUMINUM FENCE SYSTEMS

PHOENIX ALUMINUM FENCE DESIGN SYSTEM

048-090

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 331113 – SANITARY SEWAGE SYSTEM

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Extent of sanitary sewage systems work indicated on drawings and by requirements of this Section.

B. Sanitary sewer system work includes, but not limited to:
   1. Sanitary sewer pipe.
   2. Manholes, frames, and covers.

1.02 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. Section 31 2300, "Earthwork".

C. Section 31 2333, " Trenching".

D. Section, "Cast-In-Place Concrete".

E. Refer to Division section "Soil and Waste Systems" for interior building systems including drain, waste, and vent piping.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products in satisfactory use in similar service for min. 5 years.

B. Installer Qualifications: Firm with min. 3 years of successful installation experience on projects with sanitary sewage work similar to that required for Project.

C. Codes and Standards:
   1. Plumbing Code Compliance: Comply with applicable portions of Standard Plumbing Code pertaining to selection and installation of sanitary sewage system materials and products.

1.04 REFERENCED STANDARDS

A. References:
   1. The 2000 Edition of Georgia Department of Transportation "Standard Specification for Construction of Highways and Bridges"
   2. The Current Edition of Georgia Department of Natural Resources, Environmental Protection Division, “Guidelines for Gravity Sewers”

3. Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers "Recommended Standards for Wastewater Facilities"

B. American Association of State Highway and Transportation Officials (AASHTO):
   1. M-199/ M-199M: Precast Reinforced Concrete Manhole Sections

C. Standards of Uni-Bell Plastic Pipe Association:
   1. UNI-B-3: Installation of Polyvinyl Chloride (PVC) Pressure Pipe.
   2. UNI-B-4: Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe and Fittings.
   3. UNI-B-5: Installation of Polyvinyl Chloride (PVC) Sewer Pipe.
   4. UNI-B-6: Recommended Practice Low Pressure air testing of Installed Sewer Pipes

D. Standards of American Water Works Association (AWWA):
   1. C110/A21.10: Ductile Iron and Grey Iron Fittings for Water
   2. C111/A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and fittings
   3. C-151/A21.51 Ductile Iron Pipe, Centrifugally Cast for Water

E. Standards of American Society for Testing and Materials (ASTM): Use Latest Issued Specification:
   1. A 48/A 48M: Grey Iron Castings
   2. A 536: Ductile Iron Castings
   3. A 615/A 615M Deformed and Plain Carbon Steel bars for Concrete Reinforcement
   4. A 746 Ductile Iron Gravity Sewer pipe
   5. C 32 Sewer and Manhole Brick (Made From Clay or Shale)
   6. C 139 Concrete Masonry Units for Construction of Catch Basins and Manholes
   7. C 150 Portland Cement
   8. C 270 Mortar for Unit Masonry
   9. C 443 Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
   10. C 478/C 478M Precast Reinforced Concrete Manhole Sections
   11. C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
   12. C 857 Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
   13. C 877/C877M External Sealing Bands for Concrete Pipe, manholes and Precast box sections.
   14. C 891 Installation of Underground Precast Concrete Utility Structures
   15. C 923/ C923M Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and laterals.
   16. C 924 Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test

	Method
17. C 969	Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
18. C 1091	Phosphorus in Lubricating Oils and Additives
19. D 2122	Determining Dimensions of Thermoplastic Pipe and
20. D 2321	Underground Installation of Thermoplastic Pipes for Sewers and other Gravity Flow Applications
21. D 2564	Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
22. D 2665	Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
23. D 2855	Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
24. D 3034	Type PSM Poly Vinyl Chloride (PVC) Sewer pipe and Fittings
25.D 3212	Joints for Drain and Sewer Plastic pipes Using flexible Elastomeric Seals
26. F 477	Elastomeric Seals (Gaskets) for Jointing Plastic Pipe
27. F 679	Poly Vinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer pipe and Fittings
28. F 1417	Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air
29. F 1866	Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings
30. F 1970	Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems

1.05 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's technical product data and installation instructions for sewage system materials and products.

B. Shop Drawings:
   1. Submit shop drawings for sanitary sewage systems, showing piping materials, size, locations, and inverts.
   2. Include details of each underground structure, connection, and manhole. Show Invert and rim elevations. Each structure shall be shown separately in plan and profile. Generic precast information is not allowed.
   3. Provide table identifying pipe material for each pipe run. Pipe material is

required to be indicated for each location.
4. Copy of Ditch Diggers Certification.
5. Include details and installation requirements of underground structures, connections, and cleanouts.
6. Show interface and spatial relationship between piping and proximate structures.

C. Record Drawings:
1. At project closeout, submit record drawings of installed sanitary sewage piping and products, in accordance with requirements of Division 1.

D. Maintenance Data:
1. Submit maintenance data and parts lists of sanitary sewage system materials and products.
2. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.01 IDENTIFICATION

A. Detection tape is required on all pipe materials. Tracer wire is required on all non ferrous pipe material.

B. Underground-Type Plastic Line Markers:
1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; min. 6" wide x 4 mils thick.
2. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW".
3. Manufacturer: Subject to compliance with requirements, provide identification markers of one of following:
a. Allen Systems, Inc.
b. Emed Co., Inc.
c. Seton Name Plate Corp.

C. Tracer Wire:
1. Tracer Wire shall be a minimum of 12 gauge solid copper wire.
2. Wire shall run full length of pipe and stub up in manhole or structure.

2.02 CONDUIT MATERIALS

A. General:
1. Provide pipes of one of following materials, of weight/class indicated.
2. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method indicated.

B. Ductile Iron Pipe
1. Pipe: Shall Conform to ASTM A746 for thickness Class 52. Additional thickness may be required by deep cover in accordance with ASTM A746, Table 12 for type 2 laying

conditions.

2. Fittings: Shall be mechanical joints in accordance with ANSI/AWWA C-110/ A21.10 with a working pressure of 250 p.s.i.
3. Lock Joints: Shall conform to ANSI/AWWA C-151/A21.51 and shall be bolted or boltless type suitable for a working pressure of 150 p.s.i.
4. Pipe should be cut using saw or abrasive wheel. No cutting by burning allowed.

C. Cast-Iron Pipe:
1. Pipe: Shall be mechanical joint, conforming to federal specification WW-P-421C.
2. Fittings:
   a. Shall be Cast iron Class 150.
   b. Shall be Neoprene rubber compression gaskets conforming to ASTM C 564, standard strength unless otherwise indicated.
3. All interior and exterior of all cast iron pipe and fittings shall be coated with coal tar pitch.

D. Polyvinyl Chloride (PVC) Sewer Pipe: (sizes 4” thru 15”)
1. Pipe: ASTM D 3034, Type PS 115, SDR 26.
2. Fittings: PVC, ASTM D 3034, solvent-cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2564; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.

E. Polyvinyl Chloride (PVC) Sewer Pipe: (sizes 18” thru 24”)
1. Pipe: ASTM F 679, Type PS46.
2. Fittings: PVC, ASTM D 3034, solvent-cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2564; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.

F. Polyvinyl Chloride (PVC) DWV Pipe (sizes up to 4”):
1. Pipe: Schedule 40, ASTM D 2665.
2. Fittings: PVC Schedule 40, ASTM D 2665; solvent-cement joints, ASTM F 1970; or threaded or special joints. ASTM F1866.

2.03 SANITARY SEWER MANHOLES

A. General:
1. Provide either precast reinforced concrete sanitary manholes as indicated and complying with ASTM C 478 and ASTM C 857.
2. Unless noted or detailed otherwise minimum thickness of concrete to be 4".

B. Top:
1. Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated.
2. Eccentric cone precast top for depths 4'-0" and greater.
3. Flat slab tops for depth less than 4'-0".

C. Base:
1. Precast concrete, with base riser section and separate base slab, or base riser section with integral floor, as indicated.

D. Joints:
   1. Joint installation to be indicated by supplier/manufacturer.
   2. Joints shall be either approved neoprene seal or rubber gasket.
   3. The neoprene seal can be replaced with two (2) separate layers of approved 1" mastic or one (1) layer of approved 3" mastic to be placed on the flat portions of the precast section connections.
   4. All Joints shall be grouted on inside and outside.
   5. All joints shall be watertight.

E. Fall Shelves
   1. Manholes deeper that 15'-0" shall have a fall ledge(s).
   2. Design live load shall be 150 psf
   3. Ledges should be aligned 90 degrees from opening below.
   4. Ledges shall be concrete or expanded aluminum with structural supports.
   5. For manholes 15'-0" to 24'-0" in depth the shelf shall be placed at half the depth.
   6. For manholes greater than 24'-0" the shelves shall be placed at a spacing not to exceed 12'-0" max.
   7. All sewer connections shall be located below lowest ledge.

F. Steps:
   1. Grey cast iron, ASTM A 48, Class 30B, integrally cast into manhole sidewalls.
   2. Injected molded copolymer polypropylene around a 1/2" ASTM A-615 Grade 60 steel bar, meeting or exceeding ASTM C-478 and AASHTO M-199, integrally cast into basin sidewalls.

G. Frame and Cover:
   1. Grey cast iron, ASTM A 48, Class 30B, traffic type, prefitted to prevent rattling.
   2. Unless noted otherwise cover to be 26" diameter, heavy-duty, indented top design.
   3. Furnish covers with cast-in legend "Sanitary Sewer" on roadway face.
   4. Conform to details shown on drawings or to Fed. Specification RR-F-621, circular, without vents.
   5. In areas prone to flooding, sewer manhole lids shall be water tight and lockable (or bolt on.)

H. Coatings:
   1. All structures located partially or wholly below the water table shall have water proof protective coating: One of the following coatings shall be provided:
      a. Coal tar epoxy coating.
      b. Cementitious Crystalline
   2. Coal Tar Epoxy Coating
      a. All interior and exterior surfaces shall have a factory applied coal tar epoxy coating.
      b. Concrete shall be cleans and free of dust, curing compound, oil and other foreign matter.
      c. The coating shall be factory applied in two coats to achieve dry film thickness of 10 mils per coat.
   3. Cementitious Crystalline
      a. Cementitious Crystalline shall be added to concrete to provide a waterproof barrier.

b. Amount added shall be determined by manufacturer.
c. Cementitious Crystalline shall change appearance of concrete to indicate the structure has the waterproofing additive. The concrete is typically has a pink color.

I. Pipe Connectors:
a. Resilient, complying with ASTM C 923.

2.04 CLEANOUTS

A. General:
1. Provide as indicated, pipe extension to grade with ferrule and countersunk cleanout plug.
2. Provide round cast-iron access frame over cleanout, with heavy-duty secured scoriated cover with lifting device.
3. Manufacturer: Subject to compliance with requirements, provide identification markers of one of following:
a. JAY R. SMITH MFG. CO. 4250 Series.
b. ZURN MFG. CO –Jones Spec C0-2460NH4-BP
c. NIBCO

2.05 MASONRY MATERIALS

A. Concrete Masonry Units: ASTM C 139.

B. Brick: ASTM C 32, Grade MS.

C. Masonry Mortar: Use masonry mortar for below grade applications only. ASTM C 270, Type S or M.

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Installer shall examine areas and conditions under which sanitary sewer system work is to be installed and notify contractor in writing of conditions detrimental to the proper and timely completion of the work.
1. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.02 INSTALLATION OF IDENTIFICATION

A. General: Detection tape is required on all pipe materials. Tracer wire is required on all non ferrous pipe material.

B. Detection Tape: During back-filling/top-soiling of sanitary sewage systems, install continuous underground-type plastic line marker, located directly over buried line at 2’ – 0” above installed pipe.

C. Tracer wire is required to be placed to top of non ferrous pipe or wrapped the length of pipe. End shall continue into the manhole structures.

3.03 INSTALLATION OF CONDUIT

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements indicated.
   1. Inspect piping before installation to detect apparent defects.
   2. Mark defective materials with white paint and promptly remove from site.
   3. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.
   4. Place bell ends or groove ends of piping facing upstream.
   5. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.

B. Ductile Iron Pipe:
   1. Ductile Iron sewer pipe is required for sanitary sewer lines:
      a. Lines have less than three (3) feet of cover.
      b. When lines cross under storm line.
      c. When line crosses storm sewer line with less than two (2) feet of clearance between the two.
      d. When line passes laterally within one (1) foot of storm drainage structure
      e. When line is covered by sixteen (16) feet of fill or more.
      f. In wet or unstable soil conditions where bedding is difficult.
      g. When slope of the line is greater than 20%.
      h. At outside drops on manholes.
      i. Under pavement.

C. Conduit Installation: Install conduit in accordance with following industry recommendations except as specifically required on drawings or under provisions of Section 31 2300 Earthwork and Section 31 2333, Trenching.
   1. Plastic Pipe: Install in accordance with manufacturer's installation recommendations, with ASTM D 2321, and in accordance with UNI-BELL standards UNI-B-3 (pressure pipe) or UNI-B-5 (gravity pipe)

3.04 CLEANING CONDUIT

A. Clear interior of piping of dirt and other superfluous material as work progresses.
   1. Maintain swab or drag in line and pull past each joint as completed.
   2. In large, accessible piping, use brushes and brooms for cleaning.
   3. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
   4. Flush lines between manholes if required to remove collected debris.

3.05 JOINT ADAPTERS

A. Make joints between cast iron and other types of pipe with standard manufactured cast iron adapters

and fittings intended for that purpose.

B. Grout joints between cast iron pipe and concrete pipes thoroughly with cement mortar to make watertight joint.
   1. Make joints between other types of pipe with standard manufactured adapters and fittings intended for that purpose.

3.06 SEWAGE BYPASS(only when allowed)

A. Sewer is only allowed if approved by engineer and local jurisdiction.
   1. A detailed plan is to be provided prior beginning for review.
   2. Plan to meet requirements of local jurisdiction.
   3. Contractor shall be responsible for all cost associated with bypass.
   4. Contractor shall monitor bypass systems 24 hours a day for the duration of the bypass.
   5. Bypassing raw wastewater onto ground or into receiving stream is strictly prohibited.

3.07 CLOSING ABANDONED UTILITIES

A. Close open ends of abandoned underground utilities, which are indicated to remain in place.
   1. Provide sufficiently strong closures to withstand hydro-static or earth pressure resulting after ends of abandoned utilities closed.

   2. Close open ends of piping with threaded metal caps, plastic plugs, 8" thick brick masonry bulkhead, or other acceptable methods suitable for sizes and type material being closed; wood plugs not acceptable.

3.08 STONE BACKFILL

A. Where subgrade of pipe trench unsuitable material, remove 6" of unsuitable material and place stone backfill in trench to stabilize subgrade.
   1. If water is present in trench stone backfill may not be required if dewatering methods completely removes water from trench. Dewatering may be utilized to stabilize trench if soil material suitable.
   2. Stone backfill limited to areas where well pointing and other conventional methods of dewatering will not produce a dry trench bottom or where soil is unsuitable as a subgrade.
   3. Place stone 8" deep and 1'-0" wider than pipe barrel and carefully bed pipe to grade in stone.

3.09 SANITARY MANHOLES

A. General:
   1. Set manholes elevations to inverts shown on schedules and on drawings.
   2. Unless otherwise shown, set tops of frames and covers flush with finish surface in graded or paved areas.
   3. In other locations set tops 3" above finish surface, unless otherwise indicated.
   4. Place 57 stone or gravel not less than 4” at the base of each manhole.
   5. Manholes shall be constructed of precast concrete.

B. Locations: Construct manholes where shown on drawings.

C. Precast Concrete Manholes:
   1. Install in accordance with approved shop drawings.
   2. Install in accordance with ASTM C 891.
   3. Manhole Steps:
      a. Use epoxy compound where manhole steps are mortared into manhole walls.
      b. Manhole Steps shall be installed in manhole such that forms one line perpendicular to the flow line except when safety ledges are installed.
      c. Manholes steps shall be installed to align with safety ledges for manholes deeper than 15’-0”.
   4. Joints:
      a. Provide rubber joint gasket complying with ASTM C443 at joints of sections.
      b. Joints to be either approved neoprene seal or rubber gasket.
      c. The neoprene seal can be replaced with two (2) separate layers of approved 1” mastic or one (1) layer of approved 3” mastic. Mastic to be placed on the flat portions of the precast section connections.
      d. Joints to be grouted on inside and outside.
      e. All joints shall be watertight.

D. Manhole Drops:
   1. New Manholes: Outside drops shall be installed on manholes where invert of sewer line entering the manhole is 18” or more from the invert of the manhole.
   2. All Drops shall be ductile iron.

E. Manhole Inverts: Construct in accordance with applicable details and requirements contained herein:
   1. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of channels shall be made gradually and evenly.
   2. The inverts shall be formed directly in the concrete of the manhole base, or shall be built-up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section of sewer pipe through manhole and breaking out top half after surrounding concrete has hardened.
   3. Pipe connections to manhole shall be made using water stops, standard "O" ring joints, special manhole couplings, or shall be made in accordance with manufacturer's recommendations.
   4. The floor of the manhole outside the channels shall be smooth and shall slope towards the channels at not less than 1 inch per foot not more than 2 inches per foot.

   5. Free drop within manhole shall not exceed 1'-6" measured from invert of inlet pipe to the top of the floor of the manhole outside of the channels. Drop manholes shall be constructed whenever the free drop exceeds 1'-6".

F. Sampling manholes: Contractor shall install a sampling manhole at the discharge location of the grease trap.
   1. Manhole shall have a maximum of 1’-6” and a minimum of 6” drop from grease trap to

invert of manhole.

2. No other connections or laterals shall be allowed to connect to this manhole.

3.10 TAP CONNECTIONS

A. Make connections to existing piping and underground structures, so finished work conforms nearly as practicable to requirements specified for new work.
   1. All tap connections into Precast or existing structures shall be cored.
   2. Breakouts in precast or existing are NOT allowed.
   3. Connections to existing manholes the invert is to be removed or corrected for new line.
   4. Drop Connections to Existing manholes:
      a. When taping into existing the connection shall be within 18” on bottom of manhole or an outside drop shall be installed.
      b. Drops shall be installed outside the manholes where the manhole depth is greater than 8’-0” in depth
      c. Drops shall be installed inside the manholes where the manhole depth is greater than 8’-0” in depth

B. Use commercially manufactured wyes for branch connections.
   1. Field cutting into piping not permitted.
   2. Spring wyes into existing line and encase entire wye, plus 6" overlap, with min. 6" of 3,000 psi 28-day compressive strength concrete.
   3. Spring wye into existing line where branch connections made from side into existing 4" to 21" piping and encase entire wye with min. 6" of 3,000 psi 28-day compressive strength concrete.
   4. For branch connections from side into existing 24" or larger piping or to underground structures, cut opening into unit sufficiently large to allow 3" of concrete to be packed around entering connection.
      a. Cut ends of connection passing through pipe or structure wall to conform to shape of, and be flush with, inside wall, unless otherwise indicated.
      b. On outside of pipe or structure wall, encase entering connection in 6" of concrete for min. length of 12" to provide additional support or collar from connection to undisturbed ground.
      c. Provide concrete which with min. 28-day compressive strength of 3,000 psi, unless otherwise noted.
   5. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

C. Take care while making tap connections to prevent concrete or debris from entering existing piping or structure.

D. Remove debris, concrete, or other extraneous material, which may accumulate.

3.11 BACKFILLING (see trenching section for information)

A. General: Conduct backfilling operations of open-cut trenches closely following laying, jointing, and bedding or pipe, and after initial inspection and testing completed.

B. To minimize local area traffic interruptions, allow max. 100' between pipe laying and point of complete backfilling.

3.12 JACK AND BORE

A. General:
   1. Jack and bore is required on all utility crossing on right-of-ways belonging to the public and where indicated on drawings.
   2. Installation requirements.
      a. Casing shall be welded steel for entire length.
      b. Casing shall be sealed at each end.
      c. Pipe in Casing shall be Ductile Iron Pipe.
      d. Casing Spacers shall be Stainless Steel.
      e. Empty Casings shall be filled with gout and sealed.
      f. Casing should extend a minimum of 10’ beyond edge of pavement. Casing shall be extended to avoid obstructions such as ditches, other utilities or sidewalks.
      g. Casing should be constructed in accordance with Georgia Department of Transportation requirements and the local authority having jurisdiction.

3.13 FIELD QUALITY CONTROL

A. General:
   1. Inspection of the sewers should include visual inspections, deflection testing (mandrel) lamping and/or laser alignment. Deflection testing and low pressure testing should be conducted on all gravity sewer sections.
   2. Perform testing of completed piping in accordance with local authorities having jurisdiction.
   3. All testing shall be performed and/or paid for by contractor.
   4. All testing shall be witnessed by Architect/ Engineer and shall meet requirements of local jurisdiction

B. Hydraulic Testing (infiltration)
   1. Infiltration testing shall be performed in accordance with ASTM C 1091 (infiltration) and/or ASTM C969 and shall generally include the following:
      a. Plug the upper inlet end of the test section including laterals.
      b. At the lower end (outlet), collect the water and measure the quantity collected within a specific time in a calibrated container after a constant flow is generated at the pipe section outlet.
      c. An alternate measurement is to use a calibrated weir installed at the outlet.
   2. Infiltration of ground water between any two adjoining manholes shall not exceed 25 gallons per inch diameter per mile of pipe per day. When leakage exceeds this amount, the sewer shall not be accepted until repaired and retested.
   3. Testing indicated shall be performed by contractor and witnessed by Architect.
   4. Additional Testing shall be performed by contractor and witnessed by Architect to meet requirements of local jurisdiction.

C. Interior Inspection:
   1. Inspect piping to determine if line displacement or other damage occurred.

2. Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2-ft of backfill is in place, and again at completion of project.
3. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.
4. Additional test for infiltration, deflection, lateral deflection and leakage shall be required if initial tests are failed.

D. Deflection Testing: (Mandrel Test)
1. Deflection testing is required on all flexible pipes including PVC sewer pipe.
2. All deflection testing shall be performed in accordance with ASTM D3034, ASTM F679 and /or ASTM D2122.
3. Maximum deflection shall be 5 %.
4. A deflection testing shall be performed by pulling a Mandrel through the sewer line. This test shall be performed for each run of pipe.
5. Testing shall be performed by contractor and witnessed by Architect/ Engineer to meet requirements of local jurisdiction.

Pipe Size	Mandrel Diameter
8”	7.37”
10”	9.22”
12”	10.98”
15”	13.43”

E. Low Pressure Inspection:
1. A low Pressure air test shall be conducted on each section of sewer piping.
   a. Prior to inspection each section of pipe shall be thoroughly cleaned and wetted.
   b. Immediately after the pipe is clean and is water soaked, the sewer shall be tested in sections between manholes using air-lock balls.
   c. Air shall be supplied slowly to the plugged section of sewer line until it reaches approximately 4.0 psi.
   d. After the pressure is allowed to stabilize in the line approximately (3 to 5 minutes), the pressure may be reduced to 3.5 psi before starting the test.
   e. The test shall be performed for a minimum of 5 minutes or in accordance with ASTM F1417 or UNI-B-6 (whichever time is longer).
   f. If the line loses more than 1 psi of pressure in the time period the line fails and will need to be repaired or replaced.
   g. If the line does not lose more than 1 psi of pressure in the time period the line passes.
   h. Retesting is required on any portion of the line that fails the test.

F. Video Inspection:
1. Contractor to have video of inside entire length of all sewer lines including manholes after installation is complete and prior to line becoming active. Inspections after line is active are NOT acceptable.
2. The sewer line shall be cleaned prior to inspection
3. Clean water shall be place in the line prior to inspection to fill the pipe to the spring line and let run out. Then video inspection is to occur immediately after.

4. Four (4) copies of video on VHS format videotapes shall be sent to the Architect and one (1) copy to the local authority for review. Video to include the following information on the tape.
   a. Firm conducting the test
   b. Date and time
   c. Location of test
   d. Manhole locations

END OF SECTION 331113

ST. SIMONS ELEMENTARY SCHOOL
NEW CONSTRUCTION
PHASE 4 – PE BUILDING, ADMIN ADDITION AND NEW KITCHEN

SECTION 334000 – STORM SEWAGE SYSTEMS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. General: Extent of storm sewer system work shown on drawings and described herein includes, but not limited to:
   1. Storm sewer conduits
   2. Manholes, frames and covers
   3. Inlets, frames and gratings
   4. Head walls and end sections

1.02 REFERENCED STANDARD SPECIFICATIONS

A. Georgia Department of Transportation "Standard Specifications for Highways and Bridges", 1983 edition.

1.03 RELATED WORK

A. Extent of storm sewage systems work indicated on drawings and schedules, and by requirements of this Section.

B. Refer to section 312333 "Trenching" for excavation and backfill required for storm sewage systems; not work of this section.

C. Refer to sections for concrete work required for storm sewage systems; not work of this Section.

D. Refer to section "Storm Water Systems" for interior building systems including conductors, horizontal branches, and connections to roof and deck drains; not work of this section.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of storm sewage system's products of types, materials, and sizes required, whose products in satisfactory use in similar service for min. 5 years.

B. Installer's Qualifications: Firm with min. 3 years of successful installation experience on projects with storm sewage work similar to that required for Project.

C. Codes and Standards:
   1. Plumbing Code Compliance: Comply with applicable portions of Local and Standard Plumbing Code pertaining to selection and installation of storm sewage system's materials and products.
   2. Environmental Compliance: Comply with applicable portions of local Environmental Agency (Agency having Authority) regulations pertaining to storm sewage systems.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for storm sewage system materials and products.

B. Shop Drawings:
   1. Submit shop drawings for storm sewage systems, showing piping materials, size, locations, and inverts.
   2. Include details of each underground structure, connection, and manhole. Show Invert and rim elevations. Each structure shall be shown separately in plan and profile. Generic precast information is not allowed.
   3. Provide table identifying pipe material for each pipe run. Pipe material is required to be indicated for each location.
   4. Copy of Ditch Diggers Certification
   5. Show interface and spatial relationship between piping and proximate structures.

C. Record Drawings: At project closeout, submit record drawings of installed storm sewage piping and products, in accordance with requirements of Division 1.

D. Maintenance Data:
   1. Submit maintenance data and parts lists for storm sewage system materials and products.
   2. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with Division 1 requirements.

E. Producer's Statement of Applicability:
   1. Submit from manufacturer or other producer, a written-certified statement that producer reviewed proposed application of product on Project.
   2. Statement shall state that producer agrees with or does not object to Architect's specification and Contractor's selection of product for use in Work.
   3. Statement also states that proposed application of product on project is suitable and proper.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials to be installed in Georgia Department of Transportation (GDOT) right-of-way shall meet the specifications and GDOT specifications and regulations.
B. Contractor shall verify extent of work to be performed in the GDOT right-of-way with the approved permit drawings prior to ordering materials.

2.02 IDENTIFICATION

A. Underground-Type Plastic Line Markers:
   1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; min. 6" wide x 4 mils thick.
   2. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW".

3. Manufacturers: Subject to compliance with requirements, provide identification markers of one of following:
   a. Allen Systems Inc.
   b. Emed Co., Inc.
   c. Seton Name Plate Corp.

2.03 PIPE AND PIPE FITTINGS

A. General: Provide pipe fittings (ells, tees, reducing tees, wyes, couplings, increasers, cross transitions, and end caps) and accessories of same material and weight/class as pipes, with joining method indicated.

B. Material: Provide pipes of **ONE** of following materials, of weight/class indicated, unless otherwise indicated or specified.

C. Reinforced Concrete Pipe: ASTM C 76, Class III unless otherwise indicated.
   1. Fittings: Reinforced concrete, same strength as adjoining pipe, tongue- and-groove gasketed joints complying with ASTM C 443.
   2. Sizes 15” Thru 84”

D. High Density Polyethylene, Corrugated Pipe: HDPE; ASTM F2306 & AASHTO M-294; smooth interior.
   1. Fittings: Material to match pipe.
   2. Provide gaskets to form watertight connections meeting ASTM D3212
   3. Sizes 12” Thru 36”

2.04 ROOF DRAIN AND DOWN SPOUT PIPING AND FITTINGS

A. Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3034, Type PSM, SDR 35.
   1. Fittings: PVC, ASTM D 3034, solvent cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2654; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.
   2. Sizes 4” Thru 15”

B. High Density Polyethylene, Corrugated Pipe: HDPE; ASTM F2306 & AASHTO M-294; smooth interior.
   1. Fittings: Material to match pipe.
   2. Provide gaskets to form watertight connections meeting ASTM D3212
   3. Sizes 15” Thru 18”

2.05 STORM SEWER MANHOLES

A. General: Construct manholes of either pre-cast concrete or masonry as described herein:
   1. Precast reinforced concrete storm sewer manholes, complying with ASTM C 478.
   2. Unit masonry for storm sewer manholes to comply with:
      a. Concrete Masonry Units: ASTM C 139-73 (1989).
      b. Manhole Brick: ASTM C 32-73 (1990); Grade MS.
      c. Sewer Brick: ASTM C 32-73 (1990); Grade SS.

d. Masonry Mortar: ASTM C 270-89 Type M.

B. Top: Construct manhole tops of precast concrete complying with ASTM C 478-90b, with minimum structural capacity to support AASHTO H20 wheel loadings, of sizes indicated and as follows:
1. Of concentric cone, eccentric cone if structure greater than 4'-0" in depth.
2. Of flat slab top type if structure 4'-0" or less in depth.

C. Base: Cast-in-place or Precast concrete, with base riser section and separate base slab, or base riser section with integral floor, as indicated.

D. Steps:
1. Ductile-iron or aluminum, ASTM A 48-83 (1990), Class 30B, integrally cast into manhole sidewalls, unless noted otherwise.
2. Injected molded copolymer polypropylene around a 1/2" ASTM A-615 Grade 60 steel bar, meeting or exceeding ASTM C-478 and AASHTO M-199, integrally cast into basin sidewalls.

E. Frame and Cover: Ductile-iron, ASTM A 48-83 (1990), Class 30B, 26" diameter cover, heavy-duty, indented top design, with lettering cast into top reading "STORM SEWER" , the statement that “DO NOT POLLUTE DRAINS TO STREAM” and the fish symbol.

F. Pipe Connections: Resilient, complying with ASTM C 923.

2.06 CATCH BASINS / DRAINAGE INLETS

A. General: Construct catch basins of either pre-cast concrete or masonry as described herein:
1. Precast reinforced concrete catch basin, complying with ASTM C 478.
2. Structure may be round or square.
3. Unit masonry for catch basins be solid and to comply with:
a. Manhole Brick: ASTM C 32-73 (1990); Grade MS.
b. Sewer Brick: ASTM C 32-73 (1990); Grade SS.
c. Masonry Mortar: ASTM C 270-89 Type M.

B. Top: Construct catch basin tops of precast concrete complying with ASTM C 478-90b, with minimum structural capacity to support AASHTO H20 wheel loadings, of sizes indicated and as follows:
1. Of concentric cone, eccentric cone if structure greater than 4'-0" in depth.
2. Of flat slab top type if structure 4'-0" or less in depth.

C. Base: Cast-in-place or Precast concrete, with base riser section and separate base slab, or base riser section with integral floor.

D. Steps:
1. Ductile-iron or aluminum, ASTM A 48-83 (1990), Class 30B, integrally cast into basin sidewalls.
2. Injected molded copolymer polypropylene around a 1/2" ASTM A-615 Grade 60 steel bar, meeting or exceeding ASTM C-478 and AASHTO M-199, integrally cast into basin sidewalls.

E. Frame and Grate:
   1. Standard: Ductile-iron, ASTM A 48-83 (1990), Class 30B, flat grate, heavy-duty, of size indicated.
   2. Locking : Ductile-iron, ASTM A 48-83 (1990), Class 30B, flat grate, heavy-duty, of size indicated and able to be secured to prevent entry with countersunk pentagonal-head-bolt-operated.
   3. All manhole covers, grates and tops shall bear the Statement that "DO NOT POLLUTE DRAINS TO STREAM" and the fish symbol.

F. Pipe Connectors: Resilient, complying with ASTM C 923.

2.07 OUTFALLS

A. General: For headwalls larger than 24" contractor to provide safety grate to prevent entry. Grates shall be constructed from extruded aluminum. Grates shall be removed for easy access and cleaning. Headwalls in areas enclosed by chain link fence (detention pond) are not required to have safety grates.

B. Flared Ends: Unless indicated otherwise pipe outfalls to be constructed using flared end sections of piping in accordance with the following.
   1. Corrugated Metal Pipe: Precast reinforced concrete pipe with flared end and adapter fitting.
   2. Reinforced Concrete Pipe: Precast reinforced concrete pipe flared end section of construction to match piping.
   3. High Density Polyethylene Corrugated Pipe: Precast reinforced concrete pipe flared end and adapter fitting.

C. Head-Walls: Where Concrete, PVC or Metal piping is utilized or where indicated on drawings provide cast-in-place concrete head walls in accordance with the following.
   1. Construct of cast-in-place concrete as indicated, with reinforced headwall, apron, and tapered sides.
   2. Headwall shall meet GADOT Standard 1001A for straight, U type wing and 45◦ wings. Contractor to choose style unless specified.

D. Safety Slope end Sections – Metal safety slope end section shall be provided for all pipe ends as headwalls along Georgia Department of transportation Right-of-ways. End sections to comply with State of Georgia Department of Transportation, "Standard Specifications, Construction of Roads and Bridges".

E. Rip-Rap: Comply with Section 603, State of Georgia Department of Transportation, "Standard Specifications, Construction of Roads and Bridges"; Latest Edition.
   1. Provide a mixed of Type 1 and Type 3 rip-rap at every outfall to prevent washout.
      a. Up to 24" pipes provide a minimum of 15 c.y.
      b. Over 24" pipes provide a minimum of 25 c.y.
   2. Geotextile under liner : AASHTO M-288, type 1

2.08 TRENCH DRAINS

A. Cast in Place: Unless indicated otherwise trench drains to be constructed using in accordance with the following.
   1. Grates shall be Ductile-iron, ASTM A 48-83 (1990), Class 30B
   2. Grates located across sidewalks shall be pedestrian grade
   3. Trench Drains shall be constructed of using 4000psi concrete.

B. Precast: Unless indicated otherwise trench drains to be constructed using in accordance with the following
   1. Channels shall be constructed using interlocking polymer concrete and be able to withstand the following.
      a. Compressive strength 15,000 psi
      b. Tensile strength 2,800 psi
      c. Flex strength 3,000 psi
   2. Grates shall meet the following
      a. Across Sidewalks
         1) Stainless Steel
         2) Pedestrian grade.
         3) Design load: 210 psi
         4) Lockable/screw down
      b. Across roadways
         1) Ductile Iron
         2) Design load: 850 psi
         3) Rust Protection Coated
   3. Joints and sealants shall be constructed in accordance with manufactures specification.
   4. Contractor to provide all fittings, buckets, basins, end caps and outlet caps necessary to complete the drain

C. Slotted Drain: Unless indicated otherwise trench drains to be constructed using in accordance with the following
   1. Channels shall be constructed using interlocking polymer concrete and be able to withstand the following.
      a. Compressive strength 15,000 psi
      b. Tensile strength 2,800 psi
      c. Flex strength 3,000 psi
   2. Joints and sealants shall be constructed in accordance with manufactures specification.
   3. Contractor to provide all fittings, buckets, basins, end caps and outlet caps necessary to complete the drain
   4. Contractor to supply owner with cleaning tool necessary to maintain.

2.09 YARD DRAIN AND INLINE DRAINS

A. General: Provide yard drain and inline drains as indicated. Unless indicated otherwise trench drains to be constructed using in accordance with the following. These drains shall not be used under pavement for vehicular traffic.

B. Yard Drain shall be constructed of high density polyethylene. Provide watertight connections in accordance with ASTM 3212. Inlet shall also meet ASTM 3034 and ASTM F1336. Structure shall be heavy duty and capable of handling an H-25 rating.
   1. Grate shall be ductile iron with a minimum of 24” in diameter. All Grates shall be heavy duty and capable of handling an H-25 rating.
   2. Concrete collar is required at top of structure. The concrete shall extend a minimum of 1’-0” around structure.

C. Inline Drain shall be constructed of pipe in accordance with the following:
   1. Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3034, Type PSM, SDR 35.
      a. Fittings: PVC, ASTM D 3034, solvent cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2654; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.
      b. Sizes 4” Thru 15”
   2. High Density Polyethylene, Corrugated Pipe: HDPE; ASTM F2306 & AASHTO M-294; smooth interior.
      a. Fittings: Material to match pipe.
      b. Provide gaskets to form watertight connections meeting ASTM D3212
      c. Sizes 15” Thru 18”
   3. Only pipes and fitting associated with the installation shall be used.
   4. Grate top: shall be ductile iron with a minimum of 15” in diameter. All Grates shall be heavy duty and capable of handling an H-10 rating.
   5. Concrete collar is required at top of structure. The concrete shall extend a minimum of 1’-0” around structure.

2.10 DRYWELLS

A. General: Provide precast reinforced concrete drywalls as indicated, constructed of precast perforated concrete rings, with 6" minimum thickness solid concrete floor 12" larger in diameter than concrete rings, and lift-off type concrete cover with cast-in lift rings.
B. Drywells shall be provided at each exterior door with a exterior sand or gate trap.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor to examine areas and conditions, under which storm sewer system work installed.
   1. Notify Architect in writing of conditions detrimental to proper and timely completion of Work.
   2. Do not proceed with installation until unsatisfactory conditions corrected in manner acceptable to Architect.

3.02 INSTALLATION OF IDENTIFICATION

A. General: During back-filling/top-soiling of storm sewage systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade.

3.03 INSTALLATION OF PIPE AND PIPE FITTINGS

A. Installation of Piping and storm material shall not begin until detention or sediment structures are installed. Refer to Earthwork section 02300 and Erosion, Sedimentation and Pollution Control section 02370.

B. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements indicated.
   1. Refer to Trenching specification 02321 for requirements of bedding.
   2. Inspect piping before installation to detect apparent defects.
   3. Mark defective materials with white paint and promptly remove from site.
   4. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.
   5. All Metal and High Density Polyethylene Pipe to be installed and moved using nylon slings. Slings are to be used according to manufactures recommendations. No chains or wire ropes are allowed.
   6. Place bell ends or groove ends of piping facing upstream.
   7. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.

C. Installation: Install pipe and fittings of materials selected from approved materials noted above except as noted herein:
   1. Where pipes extend under paved areas (drives, pads, parking) and the pipe has a minimum of 12" of coverage use either cast iron or reinforced concrete piping; other materials listed not acceptable.
   2. Where pipes extend under paved areas (drives, pads, parking) and the pipe has less than 12" of coverage use either cast iron or reinforced concrete piping; other materials listed not acceptable. Encase pipe in 6" concrete sleeve, reinforced with WWM.

D. Reinforced Concrete Pipe shall be installed in the following locations
   1. In Public right-of-ways or easements.
   2. Lines that have fill deeper than fifteen (15) feet.
   3. Lines that have less than one (1) foot of cover.
   4. Lines located in live streams, branches or creeks.

E. Utility System Trenching:
   1. Refer to Section 02321, “Trenching”; comply with requirements therein.

F. Cast-Iron Soil Pipe: Install in accordance with applicable provisions of CISPI "Cast Iron Soil Pipe & Fittings Handbook".
   1. After inspection and min. 48 hours before installation, apply high-build bituminous coating to external surfaces in single coat in accordance with manufacturer's recommendations to attain min. dry-film thickness of 12 mils.

2. Install as specified in similar Division 15 Specifications Sections.

G. High Density Polyethylene Pipe: Install pipe and fittings in accordance with manufactures and the Corrugated Polyethylene Pipe Association recommendations.
1. Handle with care during installation to minimize damage to pipe.
2. Gravel bedding shall be required (when needed) to obtain bedding requirements indicated by manufacturer.
3. Install gaskets with bands at all joints; make watertight.

H. Corrugated Metal and Metal Coated Pipe: Install in accordance with applicable provisions of NCSPA “National Corrugated Steel Pipe Association Installation Manual".
1. Handle with care during installation to minimize damage to coating.
2. Apply factory furnished bituminous coating to surfaces damaged during installation; remove and replace where field repairs cannot be made effectively.
3. Install gaskets with bands at all joints; make watertight.

I. Reinforced Concrete Pipe: Install in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual".
1. Inspect concrete piping prior to setting; chipped, cracked or otherwise damaged pipe shall not be used.
2. Remove and replace damaged pipe with new.
3. Lift holes shall be grouted
4. Joints shall be grouted in accordance with Concrete Pipe Installation Manual.

J. Plastic: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321.
1. Install in a water tight manner with joints and pipe capable of withstanding a 20'-0" pressure head.
2. Install in a manner to avoid buoyancy when empty in place.

3.04 CLEANING PIPE (CONDUIT):

A. General: Keep interior of conduit free of dirt and other superfluous materials as work progresses.
1. Maintain swab or drag in line and pull past each joint as completed.
2. In large, accessible piping, use brushes and brooms for cleaning.
3. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
4. Flush lines between manholes if required to remove collected debris.

3.05 CONNECTIONS AND JOINTS:

A. Joint Adapters: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose or at manholes and inlets.
1. Make changes in direction or grade at manholes, inlets or with standard fittings.
2. Connect intersecting lines with structures (manholes or inlets) or standard fittings.

B. Roof Drain, Downspout and Condensate Connections:
1. Connect roof drains Downspout and condensate lines to storm drains connections with PVC and smooth interior HDPE pipe manufactured fittings. Only manufactured tee, wyes,

reducers, elbows, and cross fittings shall be used. The fittings shall be supplied by manufacturer.

2. Make fittings watertight, adequate to resist pressure head of 20 ft. of water.

3.06 CLEAN-OUTS:

A. Where indicated or required, provide and install cleanouts.
   1. Unless noted otherwise cleanouts to be placed on roof drain lines and laterals less than 12" in diameter.

B. Provide cleanouts at a maximum of 100'-0" on center, at changes in direction or elevation and at ends of line unless a grade inlet or manhole is located where cleanout is scheduled to be installed.

C. Extend full size off set line from trunk line to grade using a sweeping "Y" and straight sections as necessary. Transition from full size pipe to a 6" pipe and terminate pipe perpendicular to grade; flush with grade.
   1. Provide ductile iron from line to surface including sweeping “Y” and straight sections as necessary.
   2. Provide minimum of 16" square; 6" deep concrete pad at clean out.
   3. Provide flush screw-on brass top to cap pipe.

3.07 CLOSING ABANDONED UTILITIES:

A. Close open ends of abandoned underground utilities indicated to remain in place.

B. Provide sufficiently strong closures to withstand hydro-static or earth pressure resulting after ends of abandoned utilities closed.

C. Close open ends of concrete or masonry utilities with min. 8" thick brick masonry bulkheads.

D. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of materials being closed; wood plugs not acceptable.

3.08 INTERIOR PIPE INSPECTION:

A. Inspect piping to determine if line displacement or other damage occurred.

B. Make inspections after lines between manholes, or manhole locations, installed and approximately 2' of backfill in place, and again at completion of project.

C. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and re-inspect.

3.09 DRAINAGE STRUCTURES

A. General: Set manholes, inlets and head walls to elevations and at locations shown and scheduled.
   1. Lines shall be set straight, true and to specified slope.
   2. Provide inlet, or manhole at each change in direction of piping, whether specifically shown on drawings or not.

3. All Structures shall be placed on gravel bed not less than 12” of stone.
4. Square grates shall be oriented so that they align with adjacent surfaces (sidewalks, building, curb and gutter).

B. Piping / Drainage:
1. Extend storm drain piping completely through wall of structure and into structure 1".
2. Seal, watertight around piping where it enters structure.
3. Where pipe length is greater than required above, cut excess piping and remove.
4. Form smooth, rounded concrete channels from pipe inlet inverts to pipe outlet invert in order to promote smooth drainage.

C. Pre-Cast Structures: Install pre-cast manhole as indicated on contract documents and approved shop drawings.
1. Minimum wall thickness of manhole to be 6" unless noted otherwise.
2. Install in accordance with ASTM C 891.
3. Provide rubber joints gasket complying with ASTM C 443-a (1990) at joints of sections.
4. Use epoxy bonding compound where manhole steps mortared into concrete walls.

D. Masonry Structures:
1. Mix mortar with only enough water for workability.
   a. Retempering of mortar not permitted.
   b. Keep mortar mixing and conveying equipment clean.
   c. Do not deposit mortar upon, or permit contact with, ground.
2. Lay masonry in mortar to form full bed with ends and side joints in one operation, and with full bed vertical joints, no more than 5/8" wide.
   a. Protect fresh masonry from freezing and from rapid drying.
   b. Minimum wall thickness to be 8"; excluding mortar coating.
   c. Apply 1" thick mortar coating on both interior and exterior wall surfaces.
3. Use epoxy bonding compound where manhole steps mortared into masonry walls.

3.10 STORM DRAINAGE MANHOLES

A. General: Construct manholes of pre-cast concrete or masonry (sewer brick or CMU) in accordance with materials listed above.

B. Where manholes occur in pavements, set tops of frames and covers flush with finish surface; elsewhere, set tops 3" above finish surface, unless otherwise indicated.

3.11 CATCH BASINS

A. General: Construct catch basins to sizes and shapes indicated of either pre-cast concrete of masonry (sewer brick or CMU) as described above.

B. Set frames and grates to elevations indicated, except as noted.
1. Set top of inlet frame at 3" below adjacent grades.

C. Drain finished grades to and into inlet so as to allow for proper drainage.

3.12 OUTFALLS

A. General: Construct of concrete with 28-day min. compressive strength of 3000 psi.

B. Provide flared end sections where indicated.

C. Construct head walls to sizes and shapes indicated.

D. For headwalls larger than 24” contractor to provide safety grate to prevent entry. Grates shall be constructed from extruded aluminum. Frame shall be easily removed for cleaning.

E. Install stone rip-rap at head walls to shapes designated per plans and details.

3.13 DRYWELLS

A. General: Install as indicated, set on undisturbed native soil.

B. Fill: Pack around drywell with 1" to 2" size of crushed rock or gravel, to min. 12" beyond drywell perimeter, and full depth of drywell.

3.14 TAP CONNECTIONS

A. Make connections to existing piping and underground structures, so that finished work conforms nearly as practicable to requirements specified for new work.

B. Use commercially manufactured wyes for branch connections.
   1. Field cutting into piping not permitted.
   2. Spring wye into existing line where branch connections made from side into existing 4" to 21" piping and encase entire wye with min. 6" of 3000 psi 28-day compressive strength concrete.
   3. For branch connections from side into existing 24" or larger piping, or to underground structures, cut opening into unit sufficiently large to allow 3" of concrete packed around entering connections.
      a. Cut ends of connection passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated.
      b. On outside of pipe or structure wall, encase entering connection in 6" of concrete for min. length of 12" to provide additional support or collar from connection to undisturbed ground.
      c. Provide concrete with min. 28-day compressive strength of 3000 psi, unless otherwise indicated.
   4. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

C. Take care while making tap connections to prevent concrete or debris from entering existing piping or structure.

D. Remove debris, concrete, or other extraneous material, which may accumulate.

3.15 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing completed.

B. To minimize local area traffic interruptions, allow max. 100' between pipe laying and point of complete backfilling.

3.16 FINAL CLEANUP

A. Structures
   1. All Structures to have lift rings removed.
   2. Lids and grates to shall be accessible
   3. All Cast iron to be free of asphalt, concrete and silt
   4. All cast iron to be painted black with a rust preventing paint.

B. Pipe
   1. Shall be clean of silt and trash.

C. Headwalls and outlet structures
   1. Shall be free of silt on apron and rip rap.

3.17 FIELD QUALITY CONTROL

A. Testing:
   1. Perform testing of completed piping in accordance with local authorities having jurisdiction.
   2. Testing indicated shall be performed by contractor and witnessed by Architect.
   3. No visible leaks are allowed. Any leaks shall be repaired regardless of amount of leakage.
   4. Additional Testing shall be performed by contractor and witnessed by Architect to meet requirements of local jurisdiction.

B. Interior Inspection:
   1. Inspect piping to determine if line displacement or other damage occurred.
   2. Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2-ft of backfill is in place, and again at completion of project.
   3. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.
   4. Additional test for infiltration, deflection, laterial deflection and leakage shall be required if initial tests are failed.

C. As-Built Records: The contractor shall retain a licensed surveyor to make 'as-built' survey of all water lines and appurtenances, all sanitary and storm lines and structures, and all ditches, detention ponds and other facilities. Survey shall be extensive enough to locate facilities horizontally to the nearest 0.10' on grid, and to the nearest 0.02' vertically for lines and structure inverts and to the nearest 0.10' for ground shots. Furnish sufficient information to accurately map grades detention ponds and ditches and other drainage systems and components.

1. Contractor shall present to the architect the completed as-built survey maps signed and sealed and certified as being accurate by the registered land surveyor.

D. Contractor shall certify that sewer lines are laid straight and true to line and grade.

B. Video Inspection:
   1. Contractor to have video of inside entire length of all storm sewer lines meeting the following conditions
      a. Pipes with a diameter less than 12”
      b. Roof Drains or Down spout lines
      c. Storm line with out access points at both end of the pipe
      d. Storm Lines connected to yard drains or PVC Manufactured structures.
   2. Video shall be performed after installation is complete for a minimum of 2 months. The storm sewer line shall be cleaned prior to inspection.
   3. Clean water shall be place in the line prior to inspection to fill the pipe to the spring line and let run out for smaller diameter pipes (12” or less). For larger diameter pipes contractor to clean pipe (12” or larger). Then video inspection is to occur immediately after.
   4. Four (4) copies of video on VHS format videotapes shall be sent to the Architect for review. Video to include the following information on the tape.
      a. Firm conducting the test
      b. Date and time
      c. Location of test
      d. Manhole locations
   5. Areas failing the video inspection shall be re installed and video inspections shall be performed on places corrected.

E. Back Fill Compaction Testing: Provide following minimum number of passing field density tests for each 24" depth of compacted backfill. Tests to be performed at completion of compaction of each layer of fill.
   1. Under buildings and paving: 1 test per 100 LF
   2. Graded (Lawn) areas and shoulders: 1 test per 200 LF
   3. Other areas: 1 test per 200 LF

END OF SECTION 334000