BURDETTE ENGINEERING, INC.
TECHNICAL SPECIFICATIONS

LED LIGHTING RETROFIT PROGRAM
RIVERSIDE HIGH SCHOOL
SCHOOL DISTRICT OF GREENVILLE COUNTY, SC
PROJECT NO. 23370B

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SECTION 010010 - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

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C. Coordination and Meetings: Coordination, field engineering, utility outages and shut down, alteration project procedures, cutting and patching, preconference, site mobilization conference, progress meetings, preinstallation conference.

D. Submittals: Quality Assurance, Submittal procedures, construction progress schedules, proposed products list, shop drawings, product data, samples, manufacturers' instructions, manufacturers' certificates.

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F. Material and Equipment: Products, transportation and handling, storage and protection, products options, substitutions.

G. Starting of Systems: Starting systems, demonstration and instructions, testing adjusting and balancing.

H. Contract Closeout: Closeout procedures, final cleaning, adjusting, project record documents, operations and maintenance data, warranties, spare parts and maintenance materials.

1.2 CONTRACT

A. Contract Description: Stipulated Price.

1.3 CONTRACTOR USE OF SITE AND PREMISES

A. Access to Site: Limited to Owner, Engineer, Contractor, and the Authority having jurisdiction for enforcement of codes. Access will be after school hours, on weekends and holidays, to be coordinated with the owner.

B. Construction Operations: Limited to areas noted on Drawings.

C. Emergency Building Exits During Construction: All required emergency exits must be maintained during the duration of construction.

D. Hours of Operation: Normal working hours are considered to be after school closes and prior to next morning. Coordinate with owner for exact available hours.

E. Protection of Existing Landscape: Driving or parking over grassed areas is prohibited. All deliveries into the building shall be routed over paved areas or sidewalks. Provide protection of all existing trees and shrubs within the construction limits. Avoid use of any harmful materials or processes within the vicinity of existing trees and shrubs in or adjacent to the construction limits.

1.4 WORK SEQUENCE

A. Construct Work to accommodate Owner's occupancy requirements for the project during the construction period, coordinate construction schedule and operations with Owner.

1.5 OWNER OCCUPANCY

A. The Owner will occupy the site during the entire period of construction for the conduct of normal operations.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

1.6 SCHEDULE OF VALUES

A. Submit typed schedule, "Schedule of Values - Work in Place" on AIA form included in this manual.

B. Submit Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement.

C. Format: Itemize schedule parallel with specification sections.

D. Include within each line item, a directly proportional amount of Contractor's overhead and profit.

E. Revise schedule to list approved Change Orders, with each Application for Payment.

1.7 APPLICATIONS FOR PAYMENT

A. Submit four copies of each application on AIA Form G702 - Application and Certificate for Payment.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: One-month intervals ending on the last day of each month.

1.8 CHANGE PROCEDURES

A. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by AIA A201, 1987 Edition, Paragraph 7.4 by issuing supplemental instruction on AIA Form G710.

B. The Architect/Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications.

C. The Contractor may propose a change by submitting request for change to the Architect/Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full

documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Substitutions paragraph below.

D. Stipulated Sum Change Order: Based on proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Architect/Engineer.

E. Change Order Forms: Submit on AIA Form G701 - Change Order.

F. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.9 ALTERNATES

A. Definition: An alternate is an amount proposed by Bidders and stated on the Bid Form that will be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the scope of work or in products, materials, equipment, systems or installation methods described in Contract Documents.

B. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner - Contractor Agreement.

C. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.10 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate and clean up the work of all sections in preparation for Substantial Completion. Areas of Work designated for Owners occupancy shall occur on a daily basis timely coordination and cleanup to minimize delays in Owner's normal operations.

D. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.11 ALTERATION PROJECT PROCEDURES

A. Materials: As specified in product Sections; match existing Products and work for patching and extending work.

B. Coordinate work of alternations and renovations to expedite completion and to accommodate Owner occupancy.

C. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.

D. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

E. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patched Work to match existing adjacent Work in texture and appearance.

F. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendations to Owner.

G. Where a change of plane of 1/4 inch or more occurs, request instructions from Owner.

H. Finish surfaces as specified in individual Product Sections.

1.12 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affects:
1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed Work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods which will avoid damage to other Work and provide proper surfaces to receive patching and finishing.

E. Cut rigid materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction, completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

J. Identify any hazardous substance or condition exposed during the Work to the Owner for decision or remedy.

1.13 PRECONSTRUCTION CONFERENCE

A. Architect/Engineer will schedule a conference after Notice of Award.

B. Attendance Required: Owner, Architect/Engineer, and Contractor.

C. Agenda:

1. Distribution of Contract Documents.
2. Submission of list of Subcontractors, list of products, Schedule of Values, and progress schedule.
3. Designation of personnel representing the parties in Contract, and the Architect/Engineer.
4. Procedures and processing of field decision, submittals, substitutions, applications for payment, proposal request, Change Orders and Contract closeout procedures.
5. Scheduling.

1.14 SITE MOBILIZATION CONFERENCE

A. Architect/Engineer will schedule a conference at the Project site prior to Contractor occupancy.

B. Attendance Required: Owner, Architect/Engineer, Contractor, Contractor's Superintendent, and major Subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Security and housekeeping procedures.
6. Schedules.
7. Procedures for testing.
8. Procedures for maintaining record documents.
9. Requirements for start-up of equipment.
10. Inspection and acceptance of equipment put into service during construction period.

1.15 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to Architect/Engineer, Owner, participants, and those affected by decisions made.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

1.16 PREINSTALLATION CONFERENCES

A. Convene a preinstallation conference at work site prior to commencing work.

B. Require attendance of parties directly affecting, or affected by, work of the specific Section.

C. Notify Architect/Engineer four days in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants, with one copy to Architect/Engineer.

E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

1.17 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at job site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or interference otherwise in any reference document.

1.18 SUBMITTAL PROCEDURES

A. Transmit each submittal with transmittal.

B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

E. Schedule submittals to expedite the Project, and deliver to Architect at business address. Coordinate submission of related items.

F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

G. Provide space for Contractor and Architect review stamps.

H. Revise and resubmit submittals as required, identify all changes made since previous submittal.

I. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.19 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule (8 1/2" x 14" format) in duplicate within 10 days after date of Owner-Contractor Agreement for Architect/Engineer review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit a horizontal bar chart with separate line for each major section of Work or operation identifying first work day of each week.

E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

F. Indicate estimated percentage of completion for each item of Work at each submission.

G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and under Allowances.

1.20 PROPOSED PRODUCTS LIST

A. Within 10 days after date of Owner-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.21 SHOP DRAWINGS

A. After review, reproduce and distribute in accordance with Article on Procedures above and for Record Documents described in Section 01001 - Contract Closeout.

1.22 PRODUCT DATA

A. Submit the number of copies which the Contractor requires, plus submit two hard copies of drawings and product data 11" x 17" and smaller which will be retained by the Architect/Engineer and the Owner.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.

C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01001 - Contract Closeout.

1.23 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.24 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturer's certificate to Architect/Engineer for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.25 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.26 REFERENCES

A. Conform to reference standard by date of issue current on date for receiving bids.

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification for Architect/Engineer before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.27 TELEPHONE SERVICE

A. Provide, maintain and pay for telephone service to field superintendent at time of project mobilization.

1.28 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification Sections.

B. Protect finished floors, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

1.29 SECURITY

A. GCSD shall provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

1.30 PARKING

A. Owner will provide temporary off-street surface parking areas to accommodate construction personnel.

B. Do not allow vehicle parking along streets.

1.31 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition on a daily basis. Dispose off-site.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

1.32 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer, for similar components.

1.33 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.34 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on sloped supports, above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection. Coordinate on-storage areas with Owner at the Pre Bid Conference.

D. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

E. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.35 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with no provisions for substitution. Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.36 SUBSTITUTIONS

A. Instructions to Bidders specify time restriction for submitting requests for Substitutions during the bidding period to requirements specified in this Section. All requirements shall be met by submitting contractor in order to be considered.

B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

C. A request constitutes a representation that the Bidder:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the Substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

D. Submit cut sheets and product data of specified product and proposed substitution.

E. Provide a written letter certifying compliance with specified product and outlining differences.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revisions to the Contract Documents.

1.37 STARTING SYSTEMS

A. Coordinate schedule for light systems testing with Owner’s representative.

B. Notify Architect/Engineer seven days prior to start up of each item.

C. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify wiring and support components for equipment are complete and tested.

E. Execute testing under supervision of responsible Contractors’ personnel in accordance with manufacturer’s instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.38 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.39 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's inspection.

B. Provide submittals to Architect/Engineer and Owner that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.40 FINAL CLEANING

A. Execute final cleaning as each space is turned over to Owner.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.41 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.42 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and Modifications.

E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
2. Details not on original Contract Drawings.

F. Delete Architect/Engineer title block and seal from all documents.

G. Submit above documents along with AIA Document G706 "Contractor's Affidavit of Payment of Debts and Claims," and G707 "Consent of Surety Company to Final Payment" to Architect/Engineer with claim for final Application for Payment.

1.43 OPERATION AND MAINTENANCE DATA

A. Submit two sets prior to final inspection, bound in 8 1/2 x 11 inch text pages, three D-side ring covers.

B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below, with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, type on white paper.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.

F. Part 2: Operation and maintenance instruction, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   1. Significant design criteria.
   2. List of equipment.
   3. Parts list for each component.
   4. Operating instructions.
   5. Maintenance instructions for equipment and systems.
   6. Maintenance instructions for finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

G. Part 3: Project documents and certificates, including the following:
   1. Shop drawings and product data.
   2. Certificates.
   3. Photocopies of warranties and bonds.

H. Submit one copy of completed volumes in final form 5 days prior to final inspection. This copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.

I. Submit final volumes revised, within ten days after final inspection. One for engineer, two for owner in addition, provide digital PDF format copies for engineer and architects.

1.44 WARRANTIES

A. Provide duplicate notarized copies.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in three D-side ring binder with durable cover. Provide digital PDF format (2) copies as well.

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.45 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections and listed on drawings.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.46 CONTRACTOR LICENSES

A. Contractor is required to obtain all required licenses in the State of South Carolina. .

END OF SECTION 010010

SECTION 260500 — GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The provisions of The Supplement to Advertisement, The Instructions to Bidders, Supplement to Instruction to Bidders, General Conditions, Supplementary Conditions and all other sections of Division 1 of these Specifications shall govern the work under this Division or Section the same as if incorporated herein.

1.2 SCOPE

A. The Contractor shall provide and install complete electrical systems including all conductors, raceways, fittings, protective devices, wiring devices, fixtures, supports, and all miscellaneous hardware necessary. All of the above equipment shall be completely installed and left in proper operating condition. All electrically powered equipment shall be wired by the Contractor.

1.3 REQUIREMENTS

A. Field verification of scale on plans is directed since actual locations, distances and levels will be governed by actual field conditions.

B. In case of conflicts or discrepancies between plans, plans and specifications and/or actual field conditions, Contractor shall notify the Engineer before work is continued. Coordinate with other trades to avoid conflicts.

C. Permits, Inspections and Tests - The Contractor shall procure and pay for all permits, fees, inspections, and licenses required. Perform all tests to ensure all systems are in good operating condition.

D. Review of Material; Specific reference in the specification to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, with or without the words "or equal", shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

E. Bidders shall base bids on the material specified or on equals receiving approval 10 days prior to Bid Opening. Any increase in the cost of work resulting from substitution of any product specified is part of this contract and shall be accomplished in an approved manner at no extra cost to the Owner.

F. Substitutions. See Invitation For Bid for additional substitution requirements. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, cuts, performance and test data and any other information necessary for an evaluation. A complete submittal shall be provided per the frontend document “Request for Substitution” setting forth any changes in other materials, equipment or other Work that incorporation of the substitute would require shall be included; failure to do so does not alleviate the Contractor of his responsibility to make any and all necessary changes required for installation of the approved substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The Engineer's decision of approval or disapproval of a proposed substitution shall be final.

G. All materials shall be new and of current manufacturer. Where more than one of a type of device is used, all shall be by the same manufacturer. All materials shall conform to the grade, quality and standards of those specified.

H. Shop drawings shall be submitted in accordance with the General Conditions. Forward all shop drawings at one time. Each item shall bear project name and identifying symbol from plans. Shop Drawings required are as follows:
1. Lighting Fixtures
2. Wiring Devices
Provide additional submittal to owner with purchasing information as specified in sections 265119 and 265121

I. Interferences - The drawings are generally diagrammatic in nature, and reflect generally the existing conditions and accordingly the Contractor shall coordinate his work to avoid interferences. The Contractor shall examine the complete set of drawings and specifications for the job before installation of electrical work, coordinating locations and routings as required. Work installed by the Contractor which does interfere with another trade shall be removed and reinstalled at the Contractor's expense when directed by the Owner.

J. Workmanship shall be of the highest quality and all work shall be done by workmen skilled in the trades involved.

K. The Contractor shall guarantee all work under this contract for one year and shall be responsible for the maintenance of all electrical equipment furnished and installed under this contract for a period of one year from the date of substantial completion.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 APPLICABLE CODES AND STANDARDS

Note: The materials and installation shall conform to the minimum requirements and latest outstanding issues and revisions of the following codes, standards, and regulations wherein they apply:

NFPA No. 70, National Electrical Code, (2017 edition).

IBC (2018), IECC (2009), IFC (2018)

American National Standard, National Electrical Safety Code.

Applicable Publications of NEMA, ANSI, IEEE and IPCEA.

Underwriter's Laboratories, Inc. Standards

City, State and Local Codes and Regulations having jurisdiction.

OSHA requirements.

ADA requirements.

END OF SECTION 260500

SECTION 260501 — BASIC MATERIALS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 SCOPE

A. Contractor Furnished. Unless otherwise noted on the drawings, equipment list, or specifications, the Contractor shall furnish and install all materials, devices, and apparatus necessary for the complete electrical system. All materials and equipment shall be of types and manufacturer specified wherever practical. Should materials or equipment so specified be unobtainable, the Contractor shall submit the description and manufacturer's literature, reason for the substitution request and shall secure the approval of the Engineers before substitution of other material or equipment. This specification establishes performance requirements and the quality of equipment acceptable for use and shall in no way be construed to limit procurement from other manufacturers.

B. Equal or Equivalent. The term "or equal" and similar terms as used on the drawings or specifications shall be interpreted to mean "equal or equivalent" in the opinion of the Engineers.

C. Manufacturer's Prints. Where the Contractor furnishes equipment other than standard construction items, he shall furnish manufacturer's prints and reproducibles of all such equipment to the Engineers.

D. U.L. Listing. All equipment and materials shall be new and conform to the requirements of this specification. All equipment and materials shall be listed by the Underwriter's Laboratories, Inc., and shall bear their label whenever standards have been established and label service is regularly furnished. All equipment and materials shall be of the best grade of their respective kind for the purpose.

PART 2 - PRODUCTS AND EXECUTION

2.1 COVERS AND DEVICE PLATES

A. Contractor Furnished. Where required, the contractor shall furnish and install the appropriate cover on all boxes, conduit fittings, panels, cabinets, switches, receptacles, and similar wiring devices and other equipment that is Contractor furnished. Conduit outlet fitting covers shall be the type specified under "Conduit Fittings."

2.2 ENCLOSURES

A. Enclosures and housings for all Contractor furnished electrical equipment and devices shall be suitable for the location and environmental conditions.

END OF SECTION 260501

SECTION 260515 — DEMOLITION

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 16 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The extent of demolition work shall be in general, but not limited to, removal of existing power, cable and conduit to all removed equipment at each air handling unit, unit heater, and boiler control.

B. Demolition includes removal and disposal of demolished materials.

1.3 JOB CONDITIONS

A. Occupancy: Building will be occupied and in operation during work duration. However, all construction work required by this project will occur after school closing and prior to opening. Coordinate exact time of work with SDGC.

B. Condition of existing systems: The Owner assumes no responsibility for actual condition of items to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable.

C. Protection: Ensure safe passage of persons in and around areas of demolition. Conduct operations to prevent injury to building, structure, other facilities and persons.

D. Damages: Promptly repair damages caused to facilities by demolition operations at no cost to Owner.

E. Utility Services: Maintain existing utilities, keep in service and protect against damage during demolition operations.

F. Clean Up: Job work area to be cleaned each night of all debris, materials, etc. and returned to original state for use by school the next day.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 DEMOLITION

A. Demolition: Demolition of all parts to be removed shall be done in a safe, orderly fashion, taking care to avoid damage to parts which are to be left in place. All debris shall be removed from the premises as it is generated and shall not be allowed to accumulate. In the event the Contractor has any questions regarding items to be removed, the Contractor is to ask the Engineer.

B. Disposal of Demolished Materials:
   1. General: Remove from site, debris, rubbish and other materials resulting from demolition operations.
   2. Removal: Transport demolished materials removed from premise and legally dispose of off site.

END OF SECTION 260515

SECTION 260519 — CONDUCTORS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this Section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 SCOPE

A. This specification covers the requirements for all wire and cable to be used in the installation of the electrical systems for the project, including all, lighting, systems, should it be required.

B. Wire and cable will normally be furnished by the Contractor for installation.

C. All cable is to be "Contractor-furnished", the Contractor shall submit for approval by the Owner any deviations anticipated or proposed with respect to the cable manufacturer, cable type, or specification contained herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All wire and cable shall be Underwriters' Laboratories (UL) listed. In addition to other standard labeling, all wire and cable shall be marked UL on the outer surface indicating Underwriters' Laboratories, Inc. certification.

B. Grounding conductors, where insulated, shall be colored solid green. Conductors intended as a neutral shall be colored solid white.

C. For all circuits 600 volt and less, wires and cables shall have code grade, 600 volt type THWN-THHN, 75 degrees C., wet or dry locations, moisture and heat resistant thermoplastic insulation. Insulation thickness shall be per National Electrical Code, Table 310-13.

D. Conductor sizes are expressed in American Wire Gage (AWG) or in circular mils. Conductors shall be annealed copper wire, minimum size #12 AWG, except that #14 AWG may be used for control. All conductors shall be stranded except that solid conductors may be used for #12 AWG lighting and receptacle branch circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Separation of Usage. Lighting and power wiring shall be routed in conduits, or other raceways as shown on the drawings. Lighting and power wiring shall not be routed in a common raceway except

where shown on drawings. Push-button wiring shall be routed in separate raceways even though related to a particular motor circuit.

B. Pulling. Where mechanical assistance is used for pulling conductors, patented wire pulling compounds having inert qualities that do not harm the wire insulation or covering shall be applied to the conductors as they are pulled into raceways. Interior of all raceways shall be free from grease, filings or foreign matter before conductors are pulled in.

3.2 IDENTIFICATION

A. Wire, Cable, Raceways, and Conduits.

B. Circuit identification numbers shall be placed on each end of the conductor involved by using self-laminating marker tags, T&B Company E-Z Code Type WSL or equal. Circuit numbers shall be as shown on the plan and panel schedule drawings.

C. Phase Identification. Phase sequence throughout the installation shall be standardized wherever practical in all electrical power equipment as follows:

	Phase A	Phase B	Phase C
Position Occupied	Front	Center	Rear
	Top	Center	Bottom
	Left	Center	Right
Color Code: 208/120V, 3-phase	Black	Red	Blue
480/277V, 3-phase	Brown	Orange	Yellow

3.3 SPLICES AND TERMINATIONS

A. Lighting Conductors. Splices in lighting conductors shall be made with splicing caps with metal inserts only, such as 3M Company's "Scotchlock" spring connectors. The splices shall be firmly and neatly taped to prevent entry of moisture.

B. Power Conductors shall be continuous from outlet to outlet. No power cable shall be spliced except on explicit instructions of the Owner’s Representative.

3.4 LUGS

A. All lugs shall be furnished and installed by the Contractor where required.

B. Lugs for copper power wiring, Sizes No. 12 and No. 10 AWG, shall be T&B "Sta-Kon" uninsulated ring type lugs. Lugs for copper power wiring from No. 10 AWG to size 1/0 AWG shall be T&B 1-hole Type 54100 Series. Size 2/0 AWG and larger lugs shall be 2-hole type 54200 series (except where 1-hole is required to match motor lead lugs). Sizes above 1/0 are to be applied using hydraulic pump tool.

C. Where motor leads are furnished without lugs, T&B 54500 Series 2-way connectors (splicing sleeves) shall be used. Splice sleeves may be desirable where limited space for termination exists.

D. The proper lugs will normally be furnished with equipment in all Owner-furnished equipment. All other lugs shall be furnished and installed by the Contractor. No mechanical type lugs shall be used except in panelboards. If any mechanical type lugs are furnished with Owner-furnished equipment, the Contractor shall replace them with proper compression type lugs where practical.

3.5 TAPING

A. All voids, sharp corners and bolt projections shall be made smooth by filling with Okonite or Scotch Fill before applying the laps of tape required for insulation. All loose strands of wire shall be removed before taping. Duxseal will not be permitted.

B. Joints and other sections of wiring requiring tape shall be half lap and at least two layers. Taping shall be neatly done and shall form a permanent insulation equal in mechanical and electrical strength to the insulation of the conductor. Taping shall be as follows:

1. 600 Volt insulation - A minimum of 1-1/2 lap layer varnished cambric and 2-1/2 lap layers of 3M No. 33 vinyl plastic electrical tape.

C. All taping, splicing and termination materials shall be furnished by the Contractor.

END OF SECTION 260519

SECTION 260539 — ELECTRICAL RACEWAYS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Materials specified in this Section shall comply with all applicable requirements of SECTION 260500, GENERAL PROVISIONS.

1.2 SCOPE

A. Contractor Furnished. The contractor shall provide all conduit, fittings, and supports if required.

B. The types of electrical raceways required for the project include the following:

1. Electrical Metallic Tubing
2. Flexible Metal Conduit

C. The minimum raceway size shall be 3/4".

D. Product Delivery, Storage, and Handling. Contractor is to provide color-coded end-cap thread protectors and handle conduit and tubing carefully to prevent damage. Store pipe and tubing inside whenever possible. When necessary to store outdoors, elevate well above grade and enclose with durable, watertight wrapping.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Electrical Metallic Tubing. Galvanized, thin wall tubing, fittings shall be hex-nut, expansion gland type, zinc plated, and U.L. listed as "raintight." No crimp, spring, or set-screw type fittings will be accepted.

B. Flexible Metal Conduit. Galvanized single steel strip, flexible, interlocked.

C. Conduit, tubing and duct accessories including straps, hangers, expansion and deflection fittings as recommended by conduit, tubing, and duct manufacturers.

PART 3 - EXECUTION

a. APPLICATION

A. Electrical Metallic Tubing. Branch circuits run in hollow dry walls and above ceilings. Not to be exposed.

B. Flexible Metal Conduit. Connection of motors and for other electrical equipment where subject to movement and vibration and located in a dry, interior location. Flexible conduit is not to exceed 60" in length for any one application.

3.2 INSTALLATION

A. Install conduit and tubing in accordance with NEC and National Electrical Contractors Association's "Standard of Installation", and with recognized industry practices. Where NECA and NEC standards differ, use the more stringent requirement.

B. Complete the installation of raceways before starting installation of wires.

C. Wherever possible, install horizontal raceway runs above water and steam piping.

D. Care shall be taken to keep the interior of conduits clean, and each conduit run shall be thoroughly cleaned and dried before any cable is pulled through.

E. Unless indicated otherwise on drawings, all exposed conduits shall be run parallel with or perpendicular to building structural members.

F. Conduits entering sheet metal enclosures shall be made up with double locknut and insulating bushing. Locknut shall be of the type which will bite into the metal of the box.

G. Conduits entering threaded openings in equipment enclosures, boxes, etc., shall have at least five full threads engaged. In outdoor and underground locations, threaded joints shall be made up with a thin application of conducting joint compound. The inside of the fitting shall be thoroughly cleaned of any excess compound.

H. Power operated bending machines shall be used on conduits 1-1/4" and larger. Heating with torches will not be permitted.

I. All conduit runs shall be continuous from outlet to outlet with all joints and connections pulled tight to insure an electrically continuous and mechanically secure raceway system.

J. All raceways in "finished areas" such as offices, corridors, etc., shall be concealed.

3.3 CONDUIT AND TRAY OPENINGS

A. Contractor's Responsibility. The Contractor shall be responsible for all sleeves and openings through walls and floors necessary for passage of electrical conduits and raceways. Where contractor must provide openings and/or drill concrete floors and/or walls, he shall be responsible for the repair of these openings. Structural members and reinforcing shall not be cut, burned or damaged in any way. All openings in walls and floors, and under switchgear and panels where electrical cables and conduits are installed, shall be closed up by the Contractor to prevent dust, dirt and water from entering.

B. Sealing. The Contractor shall be responsible for sealing all wall and floor openings and all floor and wall sleeve openings utilized by the contractor whether furnished by Others or by the Contractor.

C. Sleeves and openings shall be sealed with materials that will withstand fire and heat to the same rating as the wall, floor, or ceiling through which the conduit or tray passes and shall not be less than a 30-minute barrier.

END OF SECTION 260539

SECTION 260943 – DIGITAL AND NETWORKED LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Lighting control system shall be comprised of stand-alone and networked control devices and equipment. Section Includes:

1. Lighting control relay panels.
2. Networked lighting control devices.
3. Room controllers.
4. UL 924 Load Controllers.
5. Wall stations.
6. Wireless control modules
7. Conductors and cables.

B. Related Requirements:

1. Section 2601001 "Basic Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

2. Coordinate all of the work in this section with all other trades covered in other sections of the specifications to provide a complete and operable system.

1.2 SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches, and conductors and cables.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Bill of Material including a list of components to be supplied.
4. Component schedules: Indicating lighting control device types and locations.
5. Contractor Startup Request Form – to be completed prior to factory startup
6. Operational documentation for software and firmware.

B. Shop Drawings:
1. Device specification sheets indicating device features, certifications, dimensions, construction specifications, electrical specifications, wiring diagrams, nomenclature, and related products
2. Control cable type and routing requirements.
3. For each relay panel and related equipment:

a. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
b. Detail enclosure types and details for types other than Type 1.
c. Detail wiring partition configuration, current, and voltage ratings.
d. Short-circuit current rating of relays.

4. System Riser, Wire Termination Diagrams and Schedules: Coordinate nomenclature and presentation with Drawings and block diagram. Differentiate between manufacturer-installed and field-installed wiring.
5. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. System Warranty.
1. Provide detailed warranty information covering all components within the lighting control system.

E. Closeout Submittals
1. Provide computer generated riser diagram for all networked controls equipment and devices to Manufacturer’s Representative and Facilities Manager. Riser shall represent actual final field conditions and shall include all cable ID labels, room numbers and MAC addresses for all components. (See attached sample riser diagram). Standalone controls shall not be included.
2. Provide computer generated, color-coded floorplan showing all networked lighting control zones and locations of all networked lighting control components. (See attached sample floorplan). Standalone controls shall not be included.
3. Provide computer generated, color-coded site plan showing all exterior lighting control zones, pole ID numbers, lighting fixture ID numbers, locations of building mounted PE cell, wireless radio control module and all associated room controllers and network bridges.
4. All programming databases to be sent to Manufacturer's Representative and Facilities Manager anytime programming has been altered.

F. Material Submittals
1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Quantities shall be equal to five percent of the amount installed, but no fewer than one.
a. Lighting Control Relays
b. Room Controllers (of each type installed)
c. UL924 Emergency Load Controllers
d. Occupancy Sensors
e. Network Bridge Modules
f. Wall stations (of each type installed)

1.3 SYSTEM COMPLIANCE

A. Compliance: where indicated, individual components and installation shall comply with the following requirements:
   1. NEC Compliance: as applicable to electrical wiring and component installation.
   2. NEMA Compliance: as applicable to types of electrical equipment and enclosures.
   3. UL Approval: All applicable equipment shall be tested to and listed under UL standard 508, UL standard 916 or UL924 and shall bare labels to indicate compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurance. Systems listed under ETL or other UL sections shall provide documentation proving compliance with UL standards as listed above.
   4. FCC Emissions: All applicable equipment shall comply with FCC emissions standards specified in Part 15, sub-part j for commercial and residential applications and shall bear labels indicating compliance testing. Equipment that does not meet these standards shall not be acceptable.
   5. OSF compliance: All work shall comply with OSF design guidelines for facilities.
   6. GCSD compliance: All work shall comply with the Greenville County School District Architectural Design guide.

1.4 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that components of the digital lighting control system perform in accordance with specified requirements and agrees to provide repair or replacement of components that fail to perform as specified within extended warranty period.

   1. Initial Extended Warranty Period: 5 year(s) from date of Substantial Completion, for labor, materials, and equipment.
   2. Manufacturer's warranty shall include the repair or replacement product(s) with the same or a functionally equivalent product(s) or component part(s).
   3. Manufacturer shall provide telephone technical support and remote diagnostics where applicable during normal business hours excluding manufacturer holidays.
   4. Upon request, Manufacturer shall provide quotation for manufacturer service contract option(s) which include on-site technician visits for service and repair.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All components of the digital lighting control system, whether stand-alone or networked, shall be provided from one manufacturer.

B. Basis of design is Hubbell NX Distributed Intelligence Lighting Control System.

2.2 SYSTEM DESCRIPTION

A. Lighting controls shall be provided in areas as indicated in the GCSD Architectural Design Guide, the project drawings and this specification. See attached lighting control system schedule for programming/scheduling information by area.

B. System shall consist of wired and/or wireless, distributed intelligent lighting control devices consisting of but not limited to control modules with ON/OFF, full range dimming and CCT control capabilities, and system input devices including but not limited to occupancy/vacancy sensors, daylight sensors and manual switch stations.

C. System shall provide for automatic self-configuration of system devices. Self-configuration shall be accomplished by the devices themselves and provide for control of lighting prior to system custom configuration and programming. Systems that require configuration prior to use shall be considered unacceptable.

D. To implement lighting control strategies, the system architecture shall facilitate the association of system input devices to control modules. The system shall use the Area/Zone/Group assignment strategy. The system shall support up to 128 Areas. Each area shall consist of up to 128 Zones and each zone shall consist of up to 16 Groups. Each device may be programmed to participate in one Area and Zone however may belong to one or more of the available 16 Groups within a Zone.

E. System shall provide time-of-day and astronomical clock scheduling. Each Area/Zone shall support up to 99 scheduled events for use in developing time-of-day or astronomical clock sunrise/sunset automated schedules. Each schedule shall have the ability to turn a group ON or OFF or activate a preset lighting scene at a scheduled time. Schedules shall be day-of-week selectable and may be programmed to activate on any combination of days of the week (Sunday through Saturday) or to activate on a specific date/holiday.

F. System shall support blink alerts. Relay outputs within the control modules shall be programmable to blink prior to being turned OFF. Blink alert duration time shall be adjustable. Control modules programmed for the blink alert function shall blink the controlled lighting prior to turning OFF to warn occupants of the upcoming OFF event. If an ON command is received during the blink alert time, relay output will be overridden and left ON for the override time. Override time shall be adjustable.

G. System input devices shall be deployed in a space to monitor and broadcast changes such as occupancy, daylight levels and manual switch input.

H. System customization and programming shall be performed from a mobile App and/or web-based configuration and system management tools without the need for additional hardware.

I. System shall have an intuitive and easy to use Graphical User Interface (GUI) to configure, control, monitor and schedule individual devices or groups of devices.

J. System shall remain fully functional during the programming process. Lighting control systems that must be taken “OFFLINE” for programming are not acceptable. All programming changes shall take effect immediately as they are programmed.

K. System shall be capable of being accessed from a local network or remotely using any standard Internet browser. System shall not require any special client-side software. Systems which utilize special client-side software shall not be acceptable.

L. Systems devices shall be capable of communication with each over one or all of the below methods.
1. RS485 multidrop serial network
2. Wireless mesh network
3. Ethernet TCIP network

M. Wired – RS485/Ethernet
1. System shall provide an Ethernet communication backbone (HubbNET™) for the connection of control Zones.
2. System shall utilize the RS485 standard for connection of and communications between Zone Devices.
3. System shall utilize the RS485 standard for connection of and communications between SmartPORT™ devices (e.g., Sensors, Switches and Accessories) connected within a NX Zone. M

N. Wireless – Coordinator-less, Self-Organizing/Self-Healing Mesh
1. System shall have a wireless architecture that utilizes the Synapse Network Appliance Protocol (SNAP) to create a peer-to-peer, self-organizing and self-healing mesh network infrastructure.
2. System shall be self-organizing. The mesh network of devices shall self-organize automatically without the need to manually set device addresses via dials, DIP switches or other means.
3. System shall be self-healing. System devices within the mesh network shall automatically reroute messages around a failed device to ensure message delivery.
4. System architecture shall facilitate data transmission between wireless devices over the 2.4GHz ISM radio frequency (RF) band with a supported RF range of 100ft between wireless devices indoors and 300ft outdoors.
5. System shall utilize spread spectrum frequency hopping to facilitate robust communication and prevent the unauthorized interception of messages over the air and to comply with FCC requirements.
6. System shall provide the ability to secure messages. When implemented, each device shall use the strong and secure AES-128 (Advanced Encryption Standard) security cipher to encrypt and decrypt messages. System shall also use the secure HTTPS/SSL protocol when users access the system using their Internet browser.
7. System devices shall be capable of having their firmware updated or upgraded over the air through the wireless mesh network.

O. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70 by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

P. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.

Q. Comply with UL 916

2.3 CONTROL REQUIREMENTS PER AREA

A. Exterior Lighting Controls
1. Provide one low voltage photoelectric (PE) cell, compatible with the lighting control system relay panel, mounted on the building to control all exterior lighting control zones. Provide separate network bridge module and room controller for PE cell so that it can be separately programmed.
2. All building mounted and canopy mounted fixtures shall be controlled via control panel relays or room controller relays; programming capabilities to include PE cell, scheduled control and motion sensing. Motion sensor to be in the control network, not individual to the fixture.
3. Signage and flag pole lighting shall be connected to a separate control relay for independent scheduling.
4. Pole mounted area lighting fixtures shall be provided with integral wireless control modules and occupancy sensors, and shall not be controlled via control panel relay. Provide wireless radio module at the building to connect area lighting wireless modules into control system. Provide separate network bridge module and room controller for wireless radio module so that it can be separately programmed.
5. Sequence of operations:
    a. Photocell - Primary On/Off trigger for all parking lot pole fixture, wall packs, canopy and exterior walk lights. Excludes emergency egress lighting.
    b. Schedule On/Off - Secondary control for all pole fixtures designated as General Lot Lighting, wall packs and walk lights.
    c. Motion sensing for pole fixtures – Activated on general lighting pole fixtures during scheduled ‘Off’ periods. Sensors to be integral to individual fixtures.
    d. Motion sensing for all other exterior fixtures – Activated during scheduled ‘Off’ periods for all wall packs, canopy fixtures and walk lights. Motion sensors for this function to be designed into the Network independent of any light fixtures. Owner to provide input on location of all exterior motion sensors.

B. Interior Lighting Controls
1. Educational and Classroom spaces: Provide Stand-alone digital room controller(s) with CAT 5 connections to occupancy sensors and wall stations. Provide quantity and types of room controllers and relays as required for quantity of control zones. Provide wall stations and programming of components as follows:
    a. On/Raise/Lower/Off (ORLO) switch at entrance door(s).
    b. Scene Switch at Teachers station:
        1) button #1 all lights full bright,
        2) button #2 all lights 50% bright,
        3) button #3 teaching wall row off all others 50%,
        4) button #4 all lights off.
    c. Fixture control grouping:
        1) group #1 row along teaching wall,
        2) group #2 all other fixtures.
        3) UL924 fixture placed in appropriate group the fixture is located.
    d. Set High-end trim to 80%.
    e. Occupancy sensors to be set to Vacancy Mode.
2. Media Center, Locker rooms, Kitchen areas, and Offices over 150 sf: Provide stand-alone digital room controller with CAT 5 connections to occupancy sensors and wall stations. See plans for sensor and wall station types and quantities. Provide quantity

and types of room controllers and relays as required for quantity of control zones and control requirements shown on the drawings.

3. Corridors, Lobbies and Common areas: controlled via lighting control panel relays or room controllers. Wall stations for manual control of these areas shall generally be located in admin area. Provide devices and programming as follows:
   a. Occupancy Sensors to be set to Occupancy Mode. Active during scheduled 'Off' periods.
   b. Scheduled On/Off times to correspond with open/close of facility.
   c. Program local switches that are accessible to students during school hours to be Inactive during school hours.
   d. Where dimming functionality is implemented, set High-end trim to 80%.
4. Gang toilets: Provide digital room controller with CAT 5 connections to occupancy sensors. Provide network bridge module for separate programming and integration into corridor control schedule.
5. Gymnasiums and Cafeterias: controlled via lighting control panel relays or room controllers. Wall stations for manual control of these areas shall be located in each area.

C. Emergency Lighting Controls
   1. Emergency lighting shall be controlled via digital UL924 controller to monitor normal power and override switching and dimming upon loss of normal power.

2.4 SYSTEM COMPONENTS

A. Digital Room Controller
   1. Basis of Design Product: Hubbell Control Solutions, NX Room Controllers.
   2. Room Controller(s) shall integrate the functionality of connected control components including wall switch stations, occupancy sensors and daylight sensors to provide the required sequence of operation for the space.
   3. Room Controller(s) and associated room control components shall be capable of operating in a standalone mode and without requiring the use of a network, software, computer, or server for local control functions.
   4. Construction:
      a. Room Controller housing shall be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
      b. The housing and shall include an integral 1/2" chase nipple for external mounting to standard junction box knockout.
   5. Electrical
      a. Room Controller(s) shall have a single power feed and shall be capable of operation at voltages between 120/277/347 volts AC, 50/60 Hz.
      b. One or two output relays (model specific) shall provide for the following load types and ampacity (per relay):
         1) 20A, Tungsten,
         2) 20A, Magnetic Ballast,
         3) 16A, Electronic Ballast,
         4) 1 H.P. Motor @ 120V, 3/4 H.P. @ 277V; 1/2 H.P. @ 347V
      c. Where indicated provide one or two independent 0-10 volt dimming channels (model specific) for full range dimming control of fixtures equipped with compatible dimmable ballast or driver. Each dimming output shall have a current sinking capacity of at least 30 mA.

d. Room Controller(s) shall be capable of supplying 250 mA of Class 2 auxiliary DC power for use by wall switch stations, occupancy sensors, and daylight sensors connected to the room controller's two RJ45 SmartPORT connectors.
e. Room Controller(s) shall be equipped with power monitoring circuitry capable of measuring and reporting the total connected load for each room controller.

6. Functional
   a. Provide an integral pushbutton and LED indicator for each load for status and to allow operation of the relays and dimmers for testing and verification without requiring other control devices to be connected.
   b. It shall be possible to connect up to thirty-two (32) room controllers together using Cat5 patch cables to provide configurations up to 64 switched and dimmed loads operating as a single zone.
   c. Provide the following set up and configuration functions without the need for additional devices or software:
      1) Assign/reassign relays for control by wall switch station buttons,
      2) Configure relays for occupancy or vacancy operation,
      3) Assign/reassign dimmers to raise/lower switches,
      4) Assign dimming channels for response to daylight sensor control,
      5) Auto calibrate default daylight sensor sequence of operation,
      6) Save
7. Room Controller(s) shall support fixture CCT control:
   a. Dimmer channels can be set individually to control CCT via 0-10V.
   b. Scheduling can be implemented to mimic the natural transition of light throughout the course of the day.
   c. Room-based solutions can be implemented to allow occupants to tune color to task

B. Digital UL924 Controller
1. Basis of Design Product: Hubbell Control Solutions, NX UL924 Load Controller.
2. UL924 Load Controller shall meet NFPA Article 700 requirements for emergency lighting.
3. UL924 Load Controller and associated room control components shall capable of operating in a totally standalone mode without requiring the use of a network, software, computer, or server for local control functions.
4. UL924 Load Controller shall provide a remote test button or fire alarm interface.
5. Construction:
   a. UL924 Load Controller housing shall be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
   b. The housing and shall include an integral 1/2" chase nipple for external mounting to standard junction box knockout.
6. Electrical
   a. UL924 Load Controller shall have a single power feed and shall be capable of operation at voltages between 120/277/347 volts AC, 50/60 Hz.
   b. One relay output shall provide the following load types and ampacity:
      1) 20A, Tungsten,
      2) 20A, Magnetic Ballast,
      3) 16A, Electronic Ballast,
      4) 1 H.P. Motor @ 120V, ¾ H.P. @ 277V; ½ H.P. @ 347V.
   c. UL924 Load Controller shall provide two independent 0-10 volt dimming channels for full range dimming control of fixtures equipped with compatible

dimmable ballast or driver. Each dimming output shall have a current sinking capacity of at least 30 mA.

d. UL924 Load Controller shall be equipped with power monitoring circuitry capable of measuring and reporting the total connected load for each room controller.

7. Functional
   a. SmartPORT Functionality:
      1) UL924 Load Controller shall automatically recognize connected devices in the Zone Segment.
      2) UL924 Load Controller shall function as a standard room controller.
   b. Emergency Functionality:
      1) UL924 Load Controller's RJ45 CAT5 connection shall be used as a sensing line to standard room controller on normal circuit.
      2) Removal of 24VDC on CAT5 connection shall put UL924 Load Controller into emergency state.
      3) UL924 Load Controller's default emergency state is ON with both dimming channels to 100%
   c. Provide an integral pushbutton and LED indicator for controlled load for status and to allow operation of the relay and dimmers for testing and verification without requiring other control devices to be connected.
   d. Provide the following set up and configuration functions without the need for additional devices or software:
      1) Assign/reassign relays for control by wall switch station buttons,
      2) Configure relays for occupancy or vacancy operation,
      3) Assign/reassign dimmers to raise/lower switches,
      4) Assign dimming channels for response to daylight sensor control,
      5) Save preset scenes.
8. UL924 Load Controller shall support fixture CCT control:
   a. Dimmer channels can be set individually to control CCT via 0-10V.
   b. Scheduling can be implemented to mimic the natural transition of light throughout the course of the day.
   c. Room-based solutions can be implemented to allow occupants to tune color to task.

C. In-Fixture Control Modules
1. Basis of Design Product: Hubbell Control Solutions, NX In-Fixture Modules.
2. In-Fixture Modules shall be designed to install inside the fixture they control.
3. In-Fixture Modules shall consist of a completely distributed intelligent lighting controller capable of functioning completely independently including time based and astronomical scheduling of On/Off and preset events without the need of any coordinator, gateway or master controller. Sensors and switches as well as other In-Fixture enabled fixtures shall be capable of being connected directly to the In-Fixture Module to create a fully functional lighting control system.
4. In-Fixture Module shall be provided with one SPST relay. Relay shall be supplied with "Zero Cross Switching" control to limit the effects of inrush on the relay contacts.
5. In-Fixture Module shall be compatible with incandescent, magnetic, and electronic lighting loads including LED drivers. In-Fixture Module shall include zero arc point switching circuitry.
6. Construction:
   a. Housing: GSM UL Rated 94 HB Plastic

b. Mounting: Mounts inside fixture

7. Electrical:
   a. Line Voltage Versions:
      1) Input: Universal 120-347VAC, 50-60Hz
      2) Output: One or two relay outputs (model specific) shall provide for the following load types and ampacity (per relay):
         a) 10A, 120VAC only Incandescent
         b) 10A, 120-347VAC, Magnetic Ballast
         c) 5A, 120-277VAC, Electronic Ballast
         d) 3A, 347VAC, Electronic Ballast
      3) Surge Withstand: 2000V
      4) Peak Inrush: 160A for 2 ms Max
   b. Low Voltage Versions:
      1) Input: 12-24VDC
   c. In-Fixture Modules shall be provided with two 0-10VDC control interfaces for full range dimming control of dimming ballasts and LED drivers. Interface shall be designed to continuously sink 30mA of current.
   d. In-Fixture Module 0-10VDC control interfaces shall be configurable for 0-10VDC dimming, dim to off or color temperature control.
8. Functional:
   a. In-Fixture Modules shall be rated and tested for an operating temperature range of -40° to 185°F [-40° to 85°C].
   b. NX In-Fixture Module shall be equipped with a Real Time Clock and integral backup for schedule information. Each module shall support up to 99 schedules. Schedules shall be loaded to the module via the network or locally using the NX controlHUBB App. Once loaded, schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
   c. In-Fixture Module shall be capable of having its device firmware updated wirelessly over the air when connected to a NX sensor of via the NX SmartPORT.
   d. In-Fixture Modules shall be supplied with one momentary pushbutton with LED for manual control and testing. Through the use of this switch, it shall be possible to test the On/Off and dimming functionality of the In-Fixture module or completely reset the In-Fixture Module to factory defaults without the need to connect any other device or testing equipment.
   e. In-Fixture Module shall include non-volatile memory for retaining device settings during power outages.
9. In-Fixture Module shall be UL Listed to UL916 and Certified to CAN/CSA C22.2 NO 205M1983.
10. In-Fixture Module shall be FCC certified.

D. Digital Lighting Control Panel
   1. Basis of Design Product: Hubbell Control Solutions, NX Lighting Control Panels.
   2. Panel shall be a fully distributed intelligent lighting controller with the ability to function as a stand-alone lighting control panel or as part of a networked system.
   3. Panel shall provide standard capacities for 8, 16, 24, 32, or 48 relays in each panel with matching number of 0-10v dimming channels.
   4. Panels shall be factory assembled and tested. No field assembly shall be required.
   5. Construction:

a. Panel enclosure shall have standard electrical conduit knockouts on the top, the bottom and both sides of the enclosure to allow installation flexibility. Field drilling and cutting for pipe and wire shall not be required.
b. Panel enclosure shall include 6" spacing running the width of the panel at the bottom of the panel to allow for line voltage accessories such as contactors or to provide a "gutter". Space shall be separated from the low voltage area utilizing a removable metal barrier. No knockouts added to the bottom plate of the inner high voltage divider. Exterior enclosure will maintain knockouts on bottom.
c. Panel enclosure shall feature removable metal barriers that separate all high-voltage components and wiring (Class 1) from all low-voltage (Class 2) components and wiring.
d. Panel enclosure shall be of welded construction primed and painted with a powder coat finish. Unpainted or galvanized enclosures are not acceptable.
e. Panel cover shall have hinged locking door to expose only the low voltage wiring section of the panel.
f. Panel spacing between panel relays shall be suitable for separating any two relays in the panel to meet the NEC requirements for normal and emergency power when a metal divider is installed between relays. A metal plate barrier shall be available to separate relays - two plates per application.
g. Panel relays shall be of the snap-in type and be individually field replaceable.

6. Electrical
   a. Panel shall be supplied with either a 120V/277V, 347V or 480V power supply.
   b. Panel power supply shall provide the required capacity for the operation of the panel, relays, controllers, HubbNET PoE, SmartPORTs, user interfaces and the maximum number of low voltage and/or data devices that can be connected to each panel.
   c. Panel shall have LED status/failure indicators.
   d. Panel shall include two (2) Ethernet ports for connection to the NX HUBBnet network.
   e. Panel shall include four (4) RJ45 NX SmartPORTs for the connection of all NX sensors and switches. SmartPORTs shall be capable of supplying 250 mA of Class 2 auxiliary DC power for use by wall switch stations, occupancy sensors, and daylight sensors connected to the SmartPORT connectors
   f. Panel shall have four (4) 3-wire low voltage dry contact inputs. Removable terminal blocks shall be provided to support momentary or maintained closures from building automation systems, fire systems, demand response and security systems as well as other systems or devices including occupancy sensors, daylight sensors, and low voltage switches. Each input shall be individually programmable and provide the ability to initiate any NX switch compatible function or command. (on, off, raise, lower, preset, timed on/off). Each input will provide a connection for sourcing 24V, a common, control and pilot light functionality for low voltage switch stations.
   g. Panel shall have two (2) SPDT (NO/NC) dry contact outputs, with removable terminal blocks, to provide a contact closure to signal out to another system that is capable of receiving a NO or NC closure to signal building automation, security or alarm system based on a schedule or a command from an input device (e.g. occupancy sensor, daylight sensor, wall switch station, etc.). Each output will have a contact rating of 24VDC@50mA minimum.
   h. Panel shall, after a power loss, retain time for a minimum of 72 hours.

i. Panel shall feature an optional power sensing circuit and backup battery for UL924 operation. Upon detection of loss of power, the panel shall force all relays closed and all dimming channels to full bright. Panel shall maintain this state for 90 minutes. Connected devices will not be powered.
j. Panel shall provide relay/dimmer boards to expand panel capacity from 8 to 48 relay outputs in groups of 8. Relay/dimmer boards shall be completely self-configuring and shall not require manual settings to configure for use within the panel.
k. Panel relay/dimmer boards shall have (8) 0-10V integrated dimming channels, each capable of sinking 50mA.
l. Panel dimming channels shall be software assignable.
m. Panel shall be capable of containing 1 to 48 robust and reliable mechanically latching lighting control relays as indicated on the drawings and schedules as specified herein. Electrically held or non-mechanically latching relays shall not be considered.
n. Panel relays shall be individually UL and CUL listed and shall bear labels indicating compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurances and bare labels signifying compliance.
o. Panel relays shall have the following load ratings:
1) Single Pole Relays:
a) General Use: 30A @ 300VAC
b) Tungsten: 2400W @ 120VAC
c) Standard Ballast: 20A @ 300VAC
d) Motor Starting: 1HP @ 110-125VAC; 1½ HP @ 220-277VAC
2) Double Pole Relays:
a) General Use: 20A @ 480VAC
b) Tungsten: 2400W @ 120VAC
c) Standard Ballast: 20A @ 480VAC
d) Motor Starting: 1HP @ 110-125VAC; 1½ HP at 220-277VAC
p. Panel relays shall be rated for minimum cycle life of 120,000+ operations (60,000+ cycles).
q. Panel relays shall have a Short Circuit Current Rating (SCCR) of 18,000A @ 277VAC.
r. Panel relays shall have a built-in manual override lever & ON/OFF indicator.
s. Panel relays shall be capable of manual activation On or Off with or without power.

7. Functional
a. Panel shall be of the distributed intelligence type and shall not be dependent on a network connection to execute schedules or perform programmed functions.
b. Panel shall provide the ability to update panel firmware. Firmware update process shall ensure that the complete and correct firmware (e.g. via CRC check) has been downloaded before the panel is flashed with the new firmware.

E. Wired Occupancy Sensor
1. Basis of Design Product: Hubbell Control Solutions, NX Occupancy Sensors.
2. Occupancy Sensors shall be ceiling or wall mounted and use dual technology (ultrasonic and passive infrared), ultrasonic and/or passive infrared (model specific) sensing technology as indicated.

3. Occupancy Sensors shall be Class 2 and connect to any room controller SmartPORT using a wiring adaptor and standard Cat5 patch cable.
4. NX Occupancy Sensors using both ultrasonic and passive infrared (dual technology) shall operate such that detection by both technologies is required to initiate occupancy and continued detection by either technology will maintain occupancy.

F. Wall Stations
1. Basis of Design Product: Hubbell Control Solutions, NX NXSW Series Smart Switches.
2. Push-Button Switches: Modular, momentary contact, for operating one or more relays and to override automatic controls.
   a. Match color and style specified in Section 262726 "Wiring Devices."
   b. Programable switches shall have integral LED pilot light to indicate when circuit is on.
3. Cover Plates: Single and multigang cover plates as specified in Section 262726 "Wiring Devices."
4. Legend: keycaps shall be engraved to show area served. Use designations indicated on Drawings.
5. Smart Switches shall be of the programmable type using standard Cat5 cabling for connection to system SmartPORT.
6. Smart Switches shall have one to six buttons and provide lighting control functions as called out and shown on the plans.
7. Electrical:
   a. Class 2 Low Voltage 24VDC
   b. Connection via two (2) RJ-45 SmartPORTs to allow for daisy chain connection of up to eight switches to each SmartPORT.

G. Network Bridge
1. Description: Network Bridge Module shall allow multiple room controller zones to be networked with other control system devices.
2. Network Bridge Module shall be plenum rated.
3. Network Bridge Module shall connect to and be powered from a room controller via a standard Cat5 cable.
4. Network Bridge Module shall provide a communication link between the room control devices and the NX system Area Controller via an Ethernet based network. At a minimum, the network link shall provide the following functionality through a web browser user interface:
   a. Report the current occupancy status for each lighting control zone
   b. Indicate the status of each relay and dimming channel
   c. Allow reconfiguration of system device input and output parameters
   d. Report the real time power consumption for each Room Controller
   e. Set up daylight harvesting for zones equipped with photocells
   f. Configure and download schedules to panels and Room Controllers
5. Connect relays to one or more time and sequencing schemes.

H. Conductors and Cables
1. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

2. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
3. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
4. Twisted-Pair Data Cable: Category 5e.
   a. Comply with requirements in Section 271500 "Voice and Data Cabling,"
   b. Comply with requirements in GCSD Architectural Design Guide.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

B. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Lighting control system installer shall be listed as a manufacturer trained installer.

B. Wiring
1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
2. Install cables in raceways with walls. Unenclosed wiring method may be used in accessible ceiling spaces.
3. Conceal raceway and cables except in unfinished spaces.
4. Provide plenum-rated cable, where installed exposed or in open cable tray, within environmental airspaces, including plenum ceilings.
5. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
6. CAT5 cables lengths shall not exceed 328’.
7. All CAT5 cable terminations shall be made using the T-568B wiring scheme.
8. All cable terminations shall be individually tested prior to programming and commissioning.
9. Excess cable NOT to be coiled into loops at terminations above ceiling to avoid potential signal interference.

C. Components and Equipment
1. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration & Seismic Controls for Electrical Systems."

2. Lighting controls shall be installed in accordance with manufacturer's instructions, guidelines and submittal documents provided by the lighting control manufacturer.
3. Lighting control system components shall only be installed in spaces that meet the following environmental conditions:
   a. Temperature: 32 – 104 deg F (0 - 40 deg C).
   b. Relative Humidity: 10 – 90 percent, noncondensing.
4. All stored and installed lighting control system components shall be adequately protected from dust and dirt.

3.3 IDENTIFICATION

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

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

C. All CAT5 wiring shall be provided with unique ID number. Provide a typewritten permanent ID label on both ends of each cable. Label shall be visible within 5" of each termination, and within junction box for connections to wall mounted devices

D. Create a directory within the lighting control panel to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

E. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

F. All exterior area poles and pole lighting fixtures shall be provided with a unique ID number: Poles shall be numbered sequentially (01, 02, 03, etc.), and fixtures shall be identified by the associated pole number and a letter (01a, 01b, 02a, etc.). Provide a permanent label for each fixture. Locate labels on each pole at 5' AFG, aligned vertically with each fixture head. Labels shall be 2"x4", UV protected vinyl, black numbers on white background.

3.4 COMMISSIONING AND STARTUP

A. Electrical Engineer shall schedule a design meeting with School Representative and Manufacturers Representative before 50% design drawings are issued.

B. Static IP address for lighting control processor shall be assigned by school IT department and shown on Manufacturers startup request form before onsite startup.

C. Prior to beginning installation, Electrical Contractor shall schedule a half-day pre-construction meeting with Manufacturer's representative and installing Electrical Contractor.

D. All programming shall be done by a Manufacturer-certified Lighting Control Field Technician (CFT.) A certificate of current status shall be included in the submittal documents to the Electrical Engineer.

E. Startup programming shall consist of minimum one onsite visit. Startup date shall be communicated to CFT by the Electrical Contractor by filling out the startup request form. CFT shall initiate communications between panels, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments

F. Once all required programming is completed by the CFT, the Schools Representative shall schedule a half-day programming walk-thru with the Electrical Contractor and CFT. Attendance form shall be sent to Manufacturer's Representative by CFT

G. Once programming walk-thru is completed and any requested changes made, another half-day, end user walk-thru shall be scheduled with the designated Owner's Representative. Field technician to make any requested changes. Attendance form sent to Manufacturer's Representative by CFT.

H. Coordination and assistance shall be provided to owner's Commissioning Agent as required.

3.5 TRAINING

A. End user training shall be performed by CFT. Training shall include basic troubleshooting, how to read submittals, how to process warranty claims and how to fill out button cap engraving forms. CFT shall be responsible for sending engraving forms to Manufacturer's Representative. Attendance form shall be sent to Manufacturer's Representative by CFT.

B. Training shall include 2-4 hours of instruction for 2 people, to be a combination of classroom and on-site training.

3.6 FIELD QUALITY CONTROL

A. Field tests of lighting control system must be witnessed by Owner's Representative.

B. Field tests of emergency lighting system must be witnessed by Owner's Representative and by Authority Having Jurisdiction.

C. Tests and Inspections:
   1. All lighting control components, programming, scheduling and operation shall be tested to ensure compliance with the project drawings and this specification.

D. Nonconforming Work:

   1. Lighting control system will be considered defective if it does not pass tests and inspections.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

F. Manufacturer Services:

1. Engage factory-authorized service representative to support field tests and inspections.

3.7 ADJUSTING

A. Occupancy Adjustments: within 6 months from date of Substantial Completion, CFT shall schedule meetings with the designated Owner's Representative to address any documented issues and provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.

3.8 MAINTENANCE

A. Manufacturer's Representative shall offer a cost to perform additional 12-month and 24-month jobsite visits. This amount can be included in original project bid or separately.
1. After 12 months from date of Substantial Completion, CFT Shall return to jobsite and meet with facilities group to address any documented issues.
2. After 24 months from date of Substantial Completion, CFT shall return to jobsite and meet with facilities group to address any documented issues.

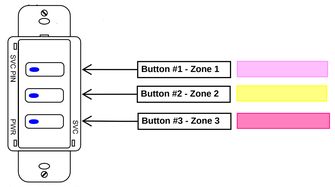
B. Software and Firmware Service Agreement:

1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software support for two years.
2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.

a. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

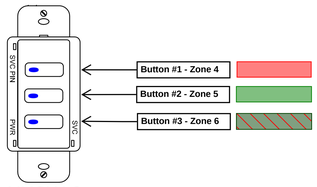
3. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

END OF SECTION 260943.23



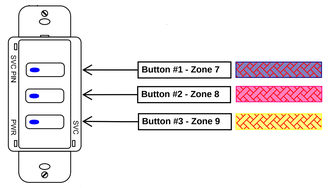
NXSW-3
(Switch 1)

D1 DETAIL Switch #1 Buttons to Zones



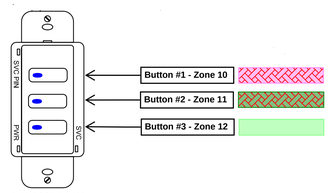
NXSW-3
(Switch 2)

D2 DETAIL Switch #2 Buttons to Zones



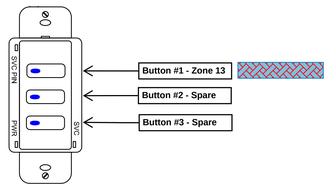
NXSW-3
(Switch 3)

D3 DETAIL Switch #3 Buttons to Zones



NXSW-3
(Switch 4)

D4 DETAIL Switch #4 Buttons to Zones



NXSW-3
(Switch 5)

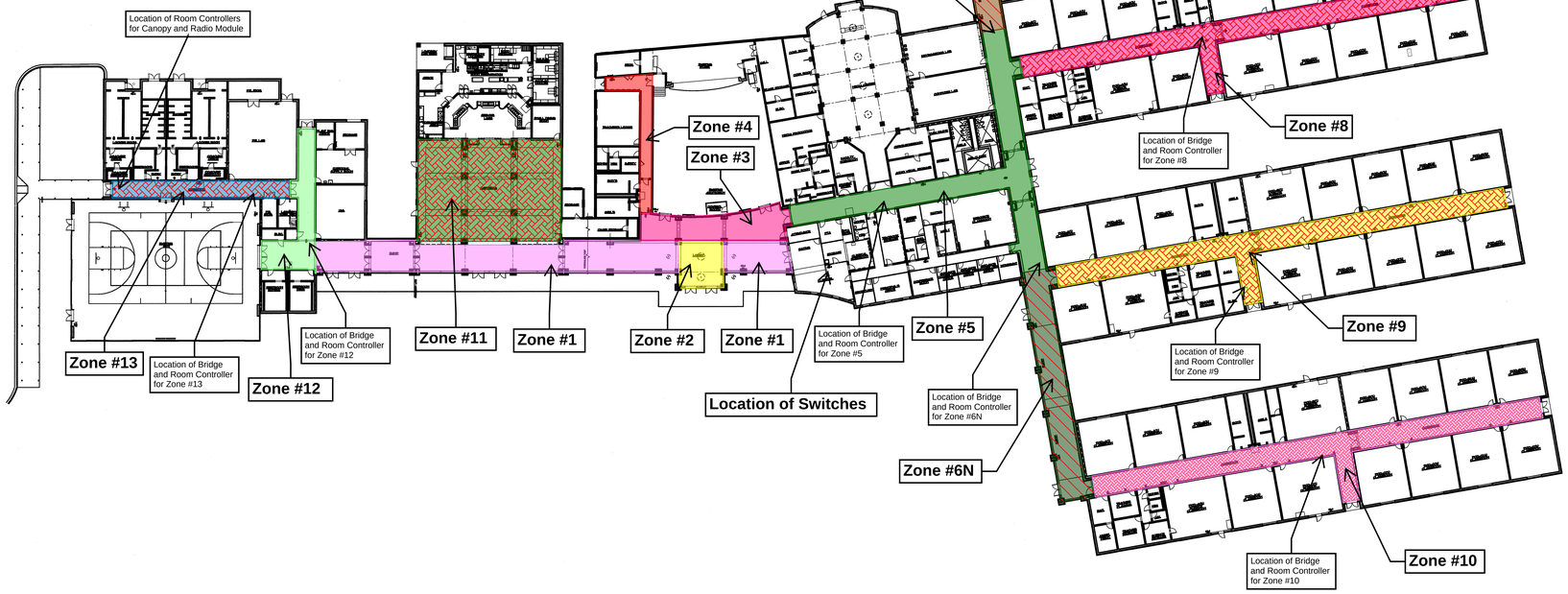
D5 DETAIL Switch #5 Buttons to Zones

Building Open/Close Time - 6am to 6pm Sunday - Saturday
All Switches Always active
Interior On Schedule - 5:00am Monday - Friday
Interior Off Schedule 7:00pm Monday - Friday
Exterior Security Lights On - Dusk to Dawn by Photocell
Exterior General Lights AM Schedule - On 5:00am - Off Dawn
Exterior General Lights PM Schedule - On Dusk - Off 10:00pm

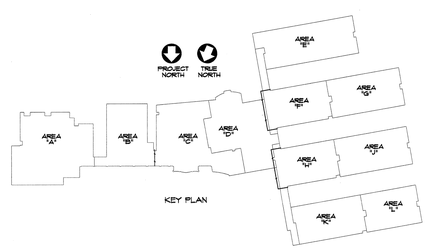
D5 Building Sequence of Operation

NOT USED

D5 DETAIL



A1 1/32"=1'-0" OVERALL FLOOR PLAN FOR LIGHTING CONTROL ZONES AND SWITCH FUNCTIONS



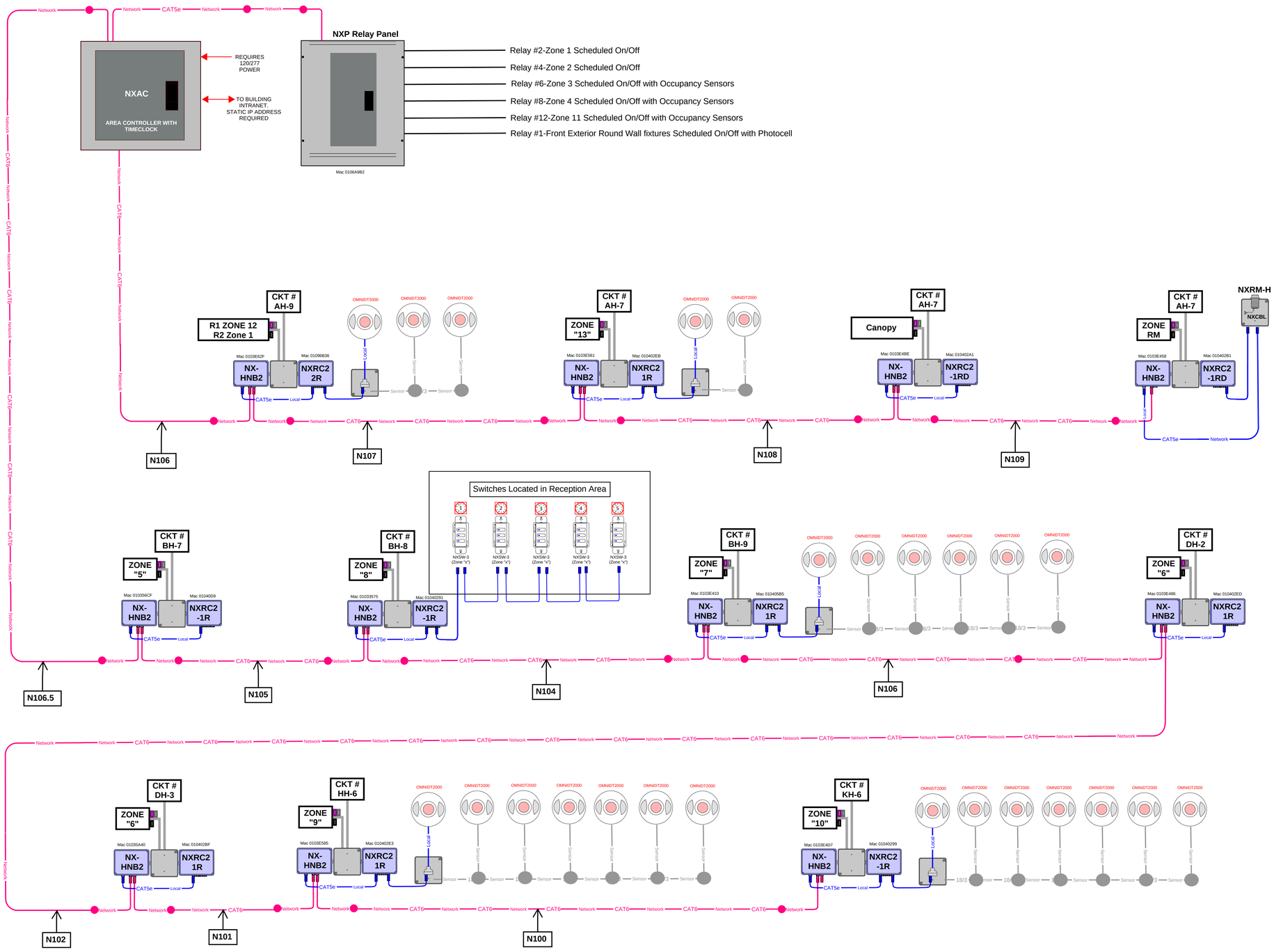
A5 N.T.S. KEY PLAN

ESSENTIAL LIGHTING SOLUTIONS

Project:
Blue Ridge Middle Lighting Controls

Drawn By: **DM**
Date: **2/3/2021**

Sheet:
LC- Zones



Project:

Blue Ridge Middle Lighting Controls Replacement

Drawn By: **DM**

Date: **5/5/2021**

Sheet:

LC- Riser

AREA	TIMECLOCK SCHEDULE	SENSOR OPERATION	LOCAL OVERRIDE IN AREA	BUILDING MASTER OVERRIDE CONTROL	DAYLIGHT HARVESTING
CORRIDORS NORMAL	ON during 5:30AM - 6:00 PM, M-F	OCCUPIED=100%, EMPTY=50%	NO	YES	NO
CORRIDORS NORMAL	OFF during 6:01 PM - 5:29AM, M-F,S,S	OCCUPIED=OFF, EMPTY=OFF	NO	YES	NO
CORRIDORS EMERGENCY	ON during 5:30AM - 6:00 PM, M-F	OCCUPIED=100%, EMPTY=50%	NO	YES	NO
CORRIDORS EMERGENCY	OFF during 6:01 PM - 5:29AM, M-F,S,S	OCCUPIED=100%, EMPTY=50%	NO	YES	NO
LARGE BATHROOMS NORMAL	ON during 5:30AM - 6:00 PM, M-F	OCCUPIED=100%, EMPTY=50%	NO	NO	NO
LARGE BATHROOMS NORMAL	OFF during 6:01 PM - 5:29AM, M-F,S,S	OCCUPIED=OFF, EMPTY=OFF	NO	NO	NO
LARGE BATHROOMS EMERGENCY	ON during 5:30AM - 6:00 PM, M-F	OCCUPIED=100%, EMPTY=50%	NO	NO	NO
LARGE BATHROOMS EMERGENCY	OFF during 6:01 PM - 5:29AM, M-F,S,S	OCCUPIED=100%, EMPTY=50%	NO	NO	NO
CLASSROOM NORMAL	NOT REQUIRED	VACANCY	ON/RAISE/LOWER/OFF STATION + SCENE STATION	NO	IF REQUIRED, MAINTAIN 45FC
CLASSROOM EMERGENCY	NOT REQUIRED	VACANCY	ON/RAISE/LOWER/OFF STATION + SCENE STATION	NO	IF REQUIRED, MAINTAIN 45FC
SMALL BATHROOM	NOT REQUIRED	OCCUPANCY	LINE VOLTAGE OCCUPANCY SENSOR	NO	NO

Note: 8 character limit

BUTTON CAP ENGRAVING	AREA
ON	CLASSROOM ENTRY
↑	CLASSROOM ENTRY
↓	CLASSROOM ENTRY
OFF	CLASSROOM ENTRY
ALL ON	TEACHER DESK
PRESENT	TEACHER DESK
ALL 50%	TEACHER DESK
ALL OFF	TEACHER DESK
↑	TEACHER DESK
↓	TEACHER DESK
CORRIDOR	BUILDING MASTER (FRONT OFFICE)
GYM	BUILDING MASTER (FRONT OFFICE)
CAFÉ	BUILDING MASTER (FRONT OFFICE)
CANOPY	BUILDING MASTER (FRONT OFFICE)
PARKING	BUILDING MASTER (FRONT OFFICE)
SIGNAGE	BUILDING MASTER (FRONT OFFICE)

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and all conditions of the procurements contractual documents apply to this Section.

1.2 SUMMARY

A. Section includes interior solid state luminaires that use LED technology, and that are shown as new on the fixture schedule.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lamp: LEDs and associated circuit board assembly.

F. LED: Light-emitting diode.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Additional Purchasing Information.

1. Immediately upon ordering fixtures, contractor shall provide a complete submittal to the owner (one submittal for each school) containing the following information in the header of the cutsheet for each fixture type ordered:
   a. Distributer contact information
   b. PO number to the manufacturer
   c. School name
   d. Month and year of order release
   e. Fixture type designation

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide cutsheets of all fixtures used, with photometrics and lumen data.
2. Provide all warranty information required by section 010010, Basic Requirements.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period. See Warranty section 010010, Basic Requirements.

B. Warranty Period: Ten years from date of Certified Substantial Completion for complete materials replacement, with one year to include labor.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. The set of criteria for the items listed below has been based upon the following considerations:

1. To set a standard of quality for product.
2. To aesthetically upgrade and provide improved lighting quality in existing facilities.
3. To help facilitate and expedite the upgrade process.
4. Ease of maintenance past initial installation.
5. To maintain or improve lighting levels within the facilities as set by OSF standards.

B. The following is a general set of criteria that all products shall adhere to:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Product shall be provided from a source which has been in the business of manufacturing lighting for a minimum of 10 years.
3. Manufacturer shall offer a 10 year warranty on all components with a ‘no-hassle’ parts replacement policy.
4. DLC or Energy Star listed products shall be utilized. All products shall be UL, ETL or CSA listed.
5. Products shall have CRI of 80 minimum, and rated life of 50,000 hours minimum to L70.

C. The following is criteria set per lighting application which will be the bulk of lighting provided:

1. 2x4 Troffer – new fixture for replacement

a. To match the appearance of the retrofit kits.

b. Available in CCT of 3500K and 4000K.
c. Available in lumen packages from 3000 through +7000. See drawings for additional lumen requirements
d. Available in 2x2 version to match 2x4.
0-10v dimming driver standard.
e. Step-dimming driver option, with multiple field-selectable mA outputs:
Osram # OT*W/CS*/UNV/SD/L.
f. Efficacy of 110 or higher.
g. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
1) Lumen Focus FFL
2) Columbia LCAT

2. 2x4 Lay-in Flat Panel – new fixture for replacement

a. Must be available in 2x2 and 1x4 configurations.
b. Available with option of surface mount and recessed flange mount frame kits in all sizes.
c. Available in CCT of 3500K and 4000K.
d. Available in lumen packages from 3000 through 5000.
e. Lens to be made of material guaranteed not to “yellow” over time.
0-10v dimming driver standard.
f. Efficacy of 110 or higher.
g. Suitable for damp locations.

3. Architectural Wall Mount Fixtures

a. Based on H.E. Williams WMA series design.
b. Available in 2’, 3’ and 4’ lengths
c. Available in lumen packages from 1500 to 6500
d. CCT of 3500K or 4000K
e. 0-10v dimming driver standard.

4. High-Bay Lights – new fixture for replacement

a. Lumen package to match that of 400w Metal Halide high-bay fixture.
b. CCT of 4000K.
c. Option of 120-277v or 347-480v input.
d. Available with aluminum and clear acrylic reflector, clear conical lens and wire guard.
e. Available with pendent or hook and cord mount options.

5. Linear Pendants

a. Fixtures shall match drawing requirements. See drawing lighting schedules for requirements.
b. Available in lengths of 4’ and 8’.
c. CCT of 3500K or 4000K.
d. 0-10v dimming driver standard.

6. Channel Strip Fixtures

a. Available in lengths of 2', 4' and 8'.
b. Available with rounded frosted lens and wireguard.
c. CCT of 3500K or 4000K
d. Lumen packages of 4000, 5000, and 6500 available per 4' section.
e. 0-10v dimming driver standard, multi-volt (120-277V)
f. Efficacy of 110 or higher.
g. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
   1) Lumen Focus ECL
   2) Cree LS
   3) Day-Brite FSS

7. Vaportight Strip Fixtures

a. Available in multiple lengths to fit a variety of applications.
b. Frosted acrylic lens, stainless steel latches and mounting clips available.
c. CCT of 3500K or 4000K
d. Lumen packages of 4000, 5000, and 6000 available per 4' section.
e. 0-10v dimming driver standard, multi-volt (120-277V)
f. Efficacy of 110 or higher.
g. Wet location rated.
h. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Housings:

1. Extruded-aluminum heat sink.
2. Powder coat finish.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece.

2.4 LUMINAIRE SUPPORT

A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 guage (2.68 mm).

C. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Do not attach luminaires directly to gypsum board.

G. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: Within 3 months of date of Substantial Completion, coordinate a site visit with Owner’s Representative to review operation of all fixtures.

1. During visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Owner’s Representative.

END OF SECTION 265119

SECTION 265121 - LED LIGHTING RETROFIT KITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All conditions of the procurement contractual documents apply to this Section.

1.2 SUMMARY

A. The intent of this specification is to allow for the procurement of LED retrofit kits for the following type fixtures:

1. All 2' and 4' fluorescent recessed troffers and surface fixtures with varying lamp quantities. Submit retrofit kits for the refitting of existing area lighting fluorescent troffers with LED Technology to replace fluorescent lamps and ballasts with new LED kits and Drivers.
2. All recessed downlighting fixtures with varying lamp quantities and wattages. Submit retrofit kits for the refitting of existing area fluorescent/incandescent/HID recessed downlights with LED technology to replace existing lamps and ballasts with new LED kits and drivers.
3. It is recognized that LED technology is evolving and that each manufacturer's standard lumen outputs, efficiencies, etc. may differ somewhat. Each bidder shall provide pricing as shown with informational data as requested in order for the Owner to evaluate the best value.
4. Units shall comply with the requirements of this specification.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lamp: LEDs and associated circuit board assembly.

F. LED: Light-emitting diode.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product to be provided with bid submittal.

1. Arrange in order of retrofit kit designation.
2. Include mounting and attachment details.

3. Include details of retrofit kit assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Include replacement door kit.
7. Photometric data and adjustment factors based on laboratory tests IES LM-79 and IES LM-80.
   a. Manufacturers' Certified Data: Photometric description of data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products or qualified independent testing agency.
8. Include diagrams for power, signal, and control wiring.

B. Samples for Verification: For each type of retrofit kit.

1. Include Samples of retrofit kit for fluorescent fixtures and downlights.

C. Additional Purchasing Information.

1. Immediately upon ordering fixtures, contractor shall provide a complete submittal to the owner (one submittal for each school) containing the following information in the header of the cutsheet for each fixture type ordered:
   a. Distributer contact information
   b. PO number to the manufacturer
   c. School name
   d. Month and year of order release
   e. Fixture type designation

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires with retrofit kits.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of kit.

D. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

E. Warranty.

1.6 QUALITY ASSURANCE

A. Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide retrofit kits from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of retrofit kits that fail in materials or workmanship within specified warranty period. See Warranty section 010010, Basic Requirements.

B. Warranty Period: Ten years from date of Certified Substantial Completion for complete materials replacement, with one year to include labor.

PART 2 - PRODUCTS

2.1 RETROFIT REQUIREMENTS

A. The acceptable manufacturers are listed on the plans. Provide submissions to document specification compliance.

B. The set of criteria for the items listed below has been based upon the following considerations:

1. To set a standard of quality for product.
2. To aesthetically upgrade and provide improved lighting quality in existing facilities.
3. To help facilitate and expedite the upgrade process.
4. Ease of maintenance past initial installation.
5. To maintain or improve lighting levels within the facilities as set by OSF standards.

C. The following is a general set of criteria that all products shall adhere to:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Product shall be provided from a source which has been in the business of manufacturing lighting for a minimum of 10 years.
3. Manufacturer shall offer a 10 year warranty on all components with a ‘no-hassle’ parts replacement policy.
4. DLC or Energy Star listed products shall be utilized. All products shall be UL, ETL or CSA listed.
5. Products shall have CRI of 80 minimum, and rated life of 50,000 hours minimum to L70.
6. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. The following is criteria set per lighting application which will be the bulk of lighting provided:

1. 2x4 Troffer Retrofit Kit

a. Kit must be Architectural style to match fixture styles indicated on plans.
b. Constructed as a hinged type, swing-down type.
c. Available in CCT of 3500K and 4000K.
d. Available in lumen packages from 3000 through +6000.
e. Available in 2x2 version to match 2x4.

f. 0-10v dimming driver standard.
g. Efficacy of 110 or higher.
h. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
    1) Columbia SLK
    2) GE LVR

2. Recessed Downlight Retrofit Kits

a. CCT of 3500K and 4000K available.
b. 0-10v dimming driver standard, multi-volt (120-277v).
c. Multiple lumen outputs available to cover a variety of applications.
d. Multiple diameters available to cover a variety of applications.
e. Damp location rated.
f. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
    1) GE LRC

3. Channel strip retrofit kit

a. Kit must be single-piece “pan” type to fit over existing channel strip fixture, with multiple widths available to accommodate existing fixture widths.
b. Kit must include rounded frosted lens, end caps and screw-retained wire guard option.
c. CCT of 3500K and 4000K available.
d. 0-10v dimming driver standard, multi-volt (120-277v).
e. Lumen outputs available between 4000 and 6500 lumens.
f. Efficacy of 110 or higher.
g. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
    1) Lumen Focus RCL
    2) Philips SL

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Factory-Applied Labels: Comply with UL 1598C. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

C. After contract has been awarded, but prior to start of construction, contractor shall schedule a site walk-through with Owner's representative to identify areas where special lighting outputs or provisions may be required.

3.2 INSTALLATION

A. Provide detailed mounting instructions with kits.

B. Install kits level, plumb, and square with existing fixtures unless otherwise indicated.

C. Install kits in each luminaire.

D. Clean all areas of installation daily such that space can be used for intended purpose the next day.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing kits, batteries and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Retrofit kit will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.4 LIGHT LEVELS

A. Light levels shall be tested upon completion of the installation to comply with the following initial light levels for space indicated.

IES Recommended Light Levels for Education (FC)		
SPACE	**IES**	**W/SQFT**
AUDITORIUM - LECTURE HALL (HOUSE,SPEAKER)	10,50	1.1
AUDITORIUM - MULTIPURPOSE ASSEMBLY (HOUSE,SPEAKER)	10,50	1.1
AUDITORIUM - PERFORMANCE (HOUSE,STAGE,PRESENTATION)	7.5,30,100	1.1
BREAKROOM	10	1.2
CAFETERIA	15	1.4
CLASSROOMS - LABS	50	1.4
CLASSROOMS - READING/WRITING	40	1.2
CLASSROOMS - SHOPS	100	1.4
CONFERENCE	30	1.2
COPY/PRINT ROOMS - GENERAL	10	1.2
COPY/PRINT ROOMS - MACHINES	30	1.2
CORRIDORS	10--20	1.2
EQUIPMENT ROOMS	20	1.2
GYMNASIUMS (SEE IES SPORTS SECTION IES FOR COMPETITIVE PLAY)	50	1.1
JANITOR	10	1.2
KITCHEN (PREP)	50	1.4
LIBRARY - COMPUTERS	15	1.3
LIBRARY - GENERAL LENDING	20--30	1.3
LIBRARY - READING	30--50	1.3
LIBRARY - STAFFED DESKS	50	1.3
LOBBIES - GENERAL	10	1.2
LOBBIES - RECEPTION DESK	40	1.2
LOBBIES - WAITING	20	1.2
OFFICES - READING/WRITING	30--50	1
STAIRS	10	1.2
STORAGE (FREQUENT)	10	1.2
TOILERS/LOCKER ROOM - FIXTURES	15	1.2
TOILERS/LOCKER ROOM - SHOWER	10	1.2
TOILETS/LOCKER ROOM - GENERAL	5	1.2
	AVERAGE W/SQFT	1.22

3.5 ADJUSTING

A. Occupancy Adjustments: Within 3 months of date of Substantial Completion, coordinate a site visit with Owner's Representative to review operation of all fixtures.

1. During visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Owner's Representative.

END OF SECTION 265121

SECTION 265619 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and all conditions of the procurement contractual documents apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lamp: LEDs and associated circuit board assembly.

F. LED: Light-emitting diode.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type.

    a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Photoelectric relays.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.

1. Provide cut sheets of all fixtures used, with photometrics and lumen data.
2. Provide all warranty information required by section 010010, Basic Requirements.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period. See “Warranty” portion of section 010010, Basic Requirements.

1. Warranty Period: Ten years from the date of certified substantial completion for complete materials replacement, with one year to include labor.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. The set of criteria for the items listed below has been based upon the following considerations:

1. To set a standard of quality for product.
2. To aesthetically upgrade and provide improved lighting quality in existing facilities.
3. To help facilitate and expedite the upgrade process.
4. Ease of maintenance past initial installation.
5. To maintain or improve lighting levels within the facilities as set by OSF standards.

B. The following is a general set of criteria that all products shall adhere to:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Product shall be provided from a source which has been in the business of manufacturing lighting for a minimum of 10 years.
3. Manufacturer shall offer a 10 year warranty on all components with a ‘no-hassle’ parts replacement policy.
4. DLC or Energy Star listed products shall be utilized. All products shall be UL, ETL or CSA listed.
5. Products shall have CRI of 80 minimum, and rated life of 50,000 hours minimum to L70.

C. The following is criteria set per lighting application which will be the bulk of lighting provided:

1. Pole Mounted Area and Site:

a. To match the appearance, finish and performance of fixtures specified on drawings.
b. Available in CCT of 4000K and 5000K.
c. Available in lumen packages from 10,000 thru 18,000. See drawings for additional lumen requirements.
d. Full cutoff optics, available in IES distribution types II, III, IV, and V.
e. Efficacy of 80 or higher.
f. 0-10v dimming driver standard, Multi-volt (120-277V) and 480V available.
g. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
    1) Gardco ECF
    2) Cree OSQ

2. Wall Packs:

a. To match the appearance, finish and performance of fixtures specified on drawings.
b. Available in CCT of 4000K and 5000K.
c. Available in lumen packages from 3,500 thru 7,000. See drawings for additional lumen requirements.
d. Full cutoff optics, available in wide and forward throw distribution types.
e. Efficacy of 90 or higher.
f. 0-10v dimming driver standard, Multi-volt (120-277V) and 480V available
g. Acceptable manufacturers: In addition to manufacturers and part numbers listed in fixture schedule on the drawings, and subject to the description, specifications and part numbers and accessories listed on the bid documents, the following manufacturers are approved to bid for this fixture type. Any fixtures failing to meet these requirements or to provide acceptable documentation will be rejected.
    1) Gardco 101L

2.2 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

I. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Luminaire will be considered defective if it does not pass tests and inspections.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 ADJUSTING

A. Occupancy Adjustments: Within 3 months of date of Substantial Completion, coordinate a site visit with Owner’s Representative to review operation of all fixtures.

1. During visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Owner’s Representative.

END OF SECTION 265619